THE CP/M USER'S JOURNAL

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Microsystems

Volume 4/Number 3

March 1983

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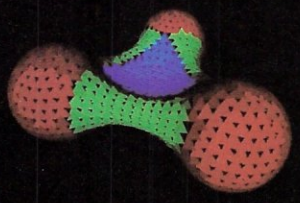
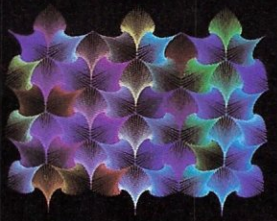
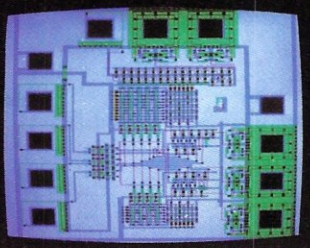


"Three Atoms" Courtesy of Greg Abram, University of North Carolina at Chapel Hill



"Aurora" By Richard Katz, Vectrix Corporation



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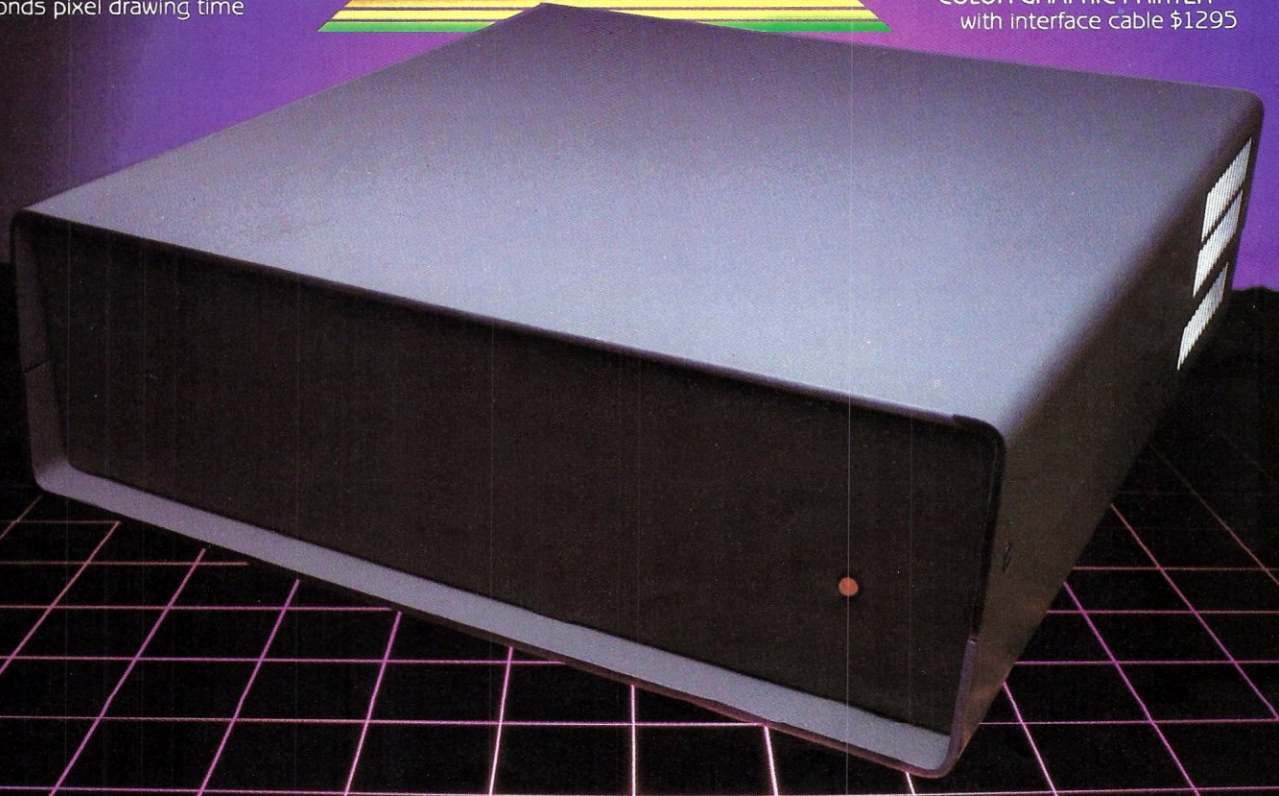

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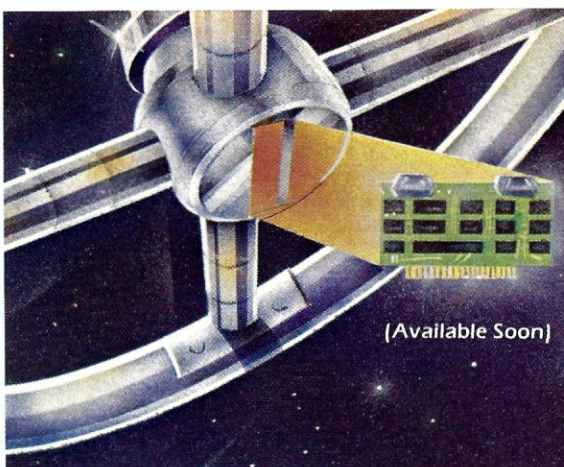

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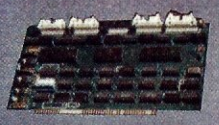

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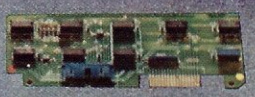

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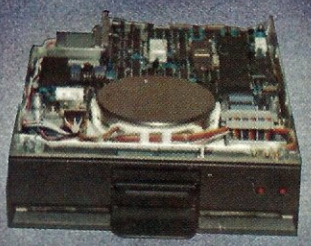

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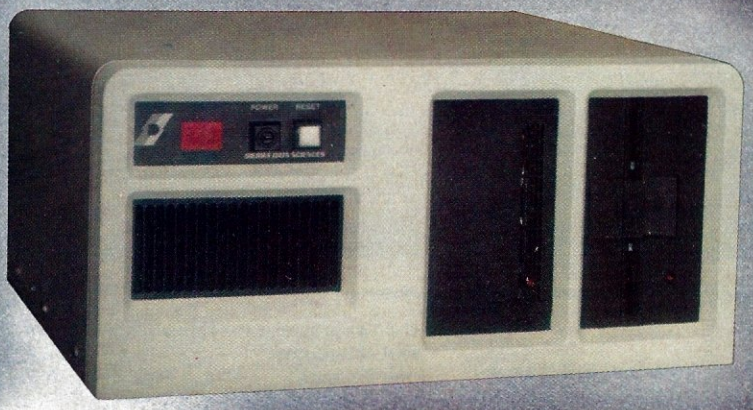

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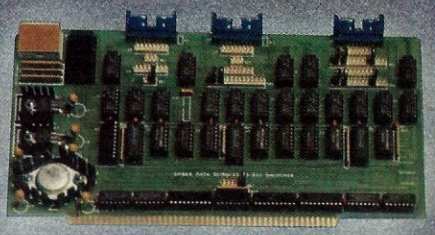

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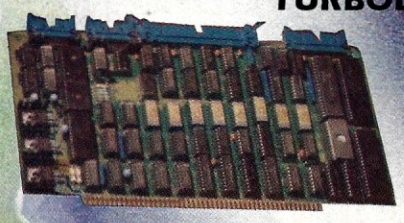

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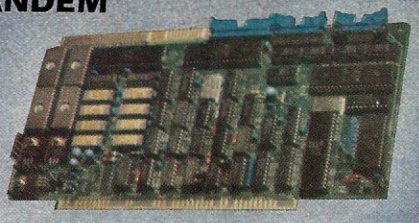

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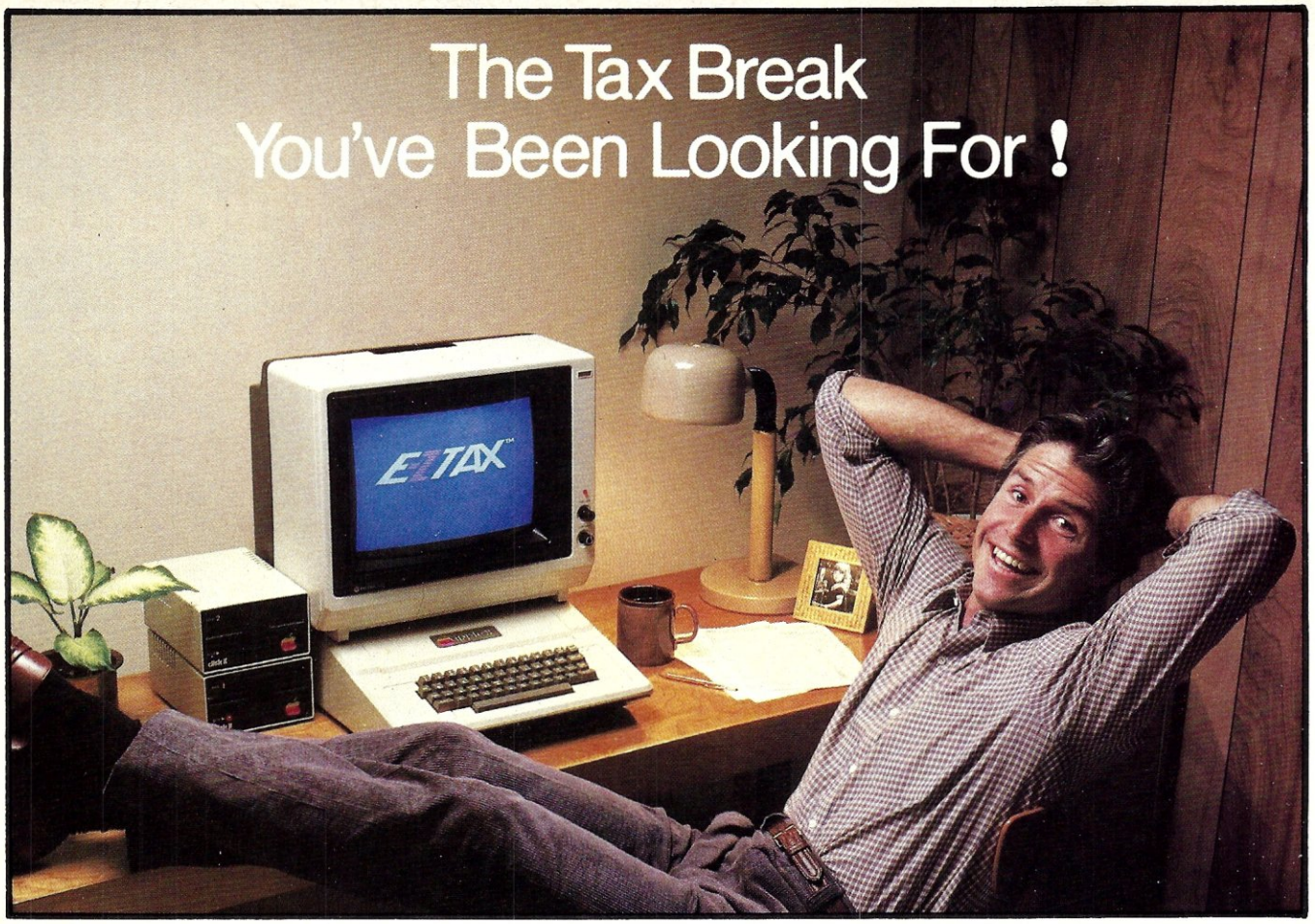

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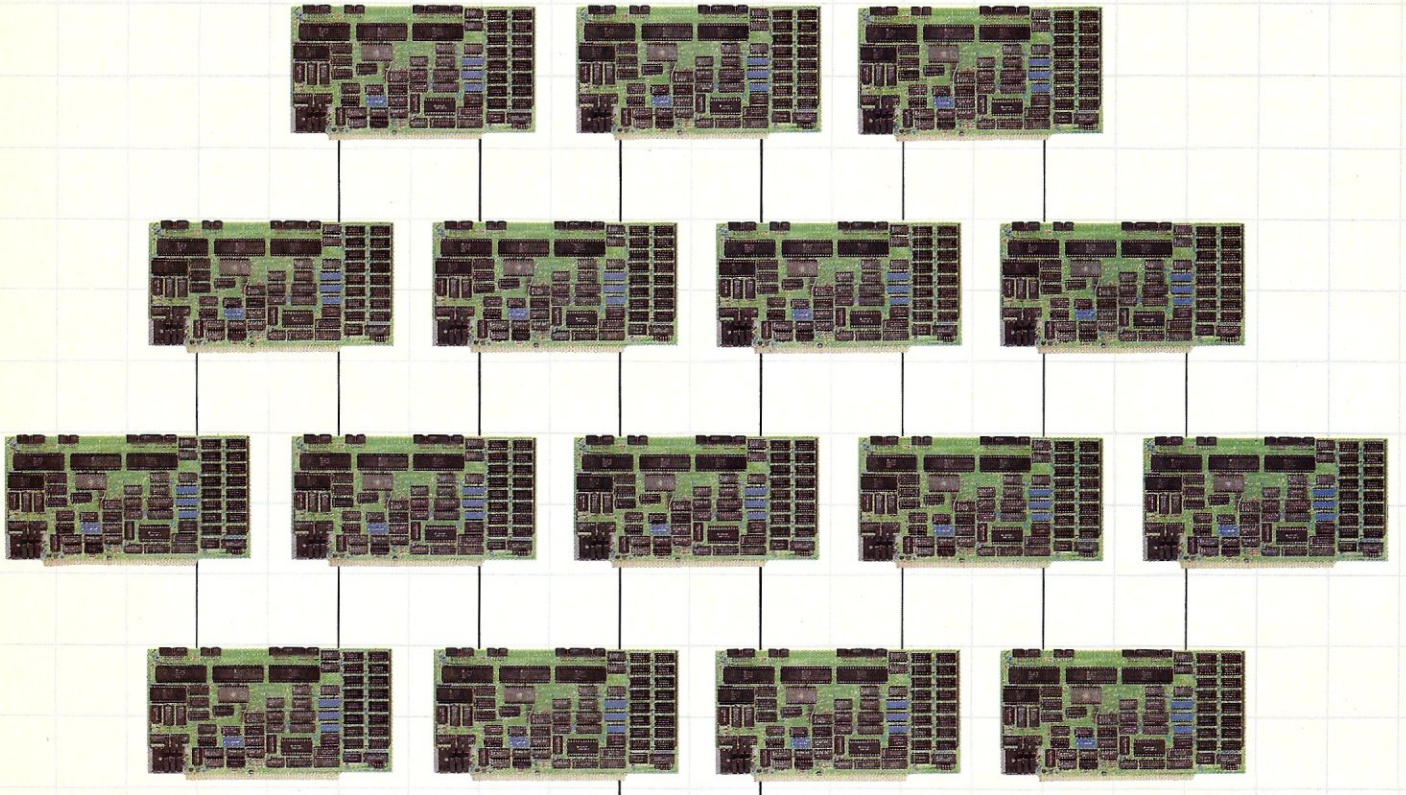

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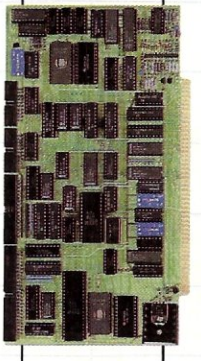

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CIRCLE 24 ON READER SERVICE CARD

Contents

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Volume 4/Number 3
March 1983

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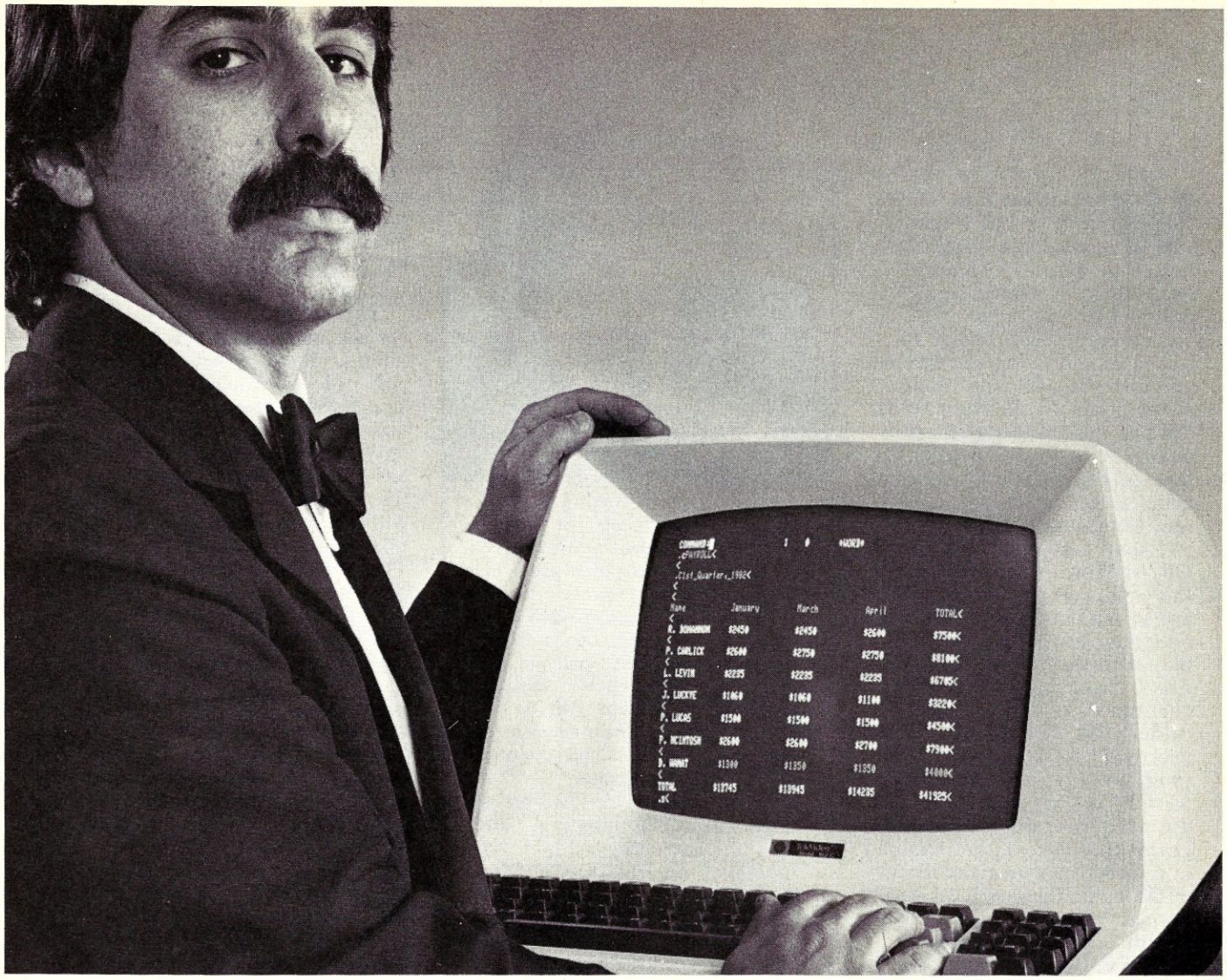

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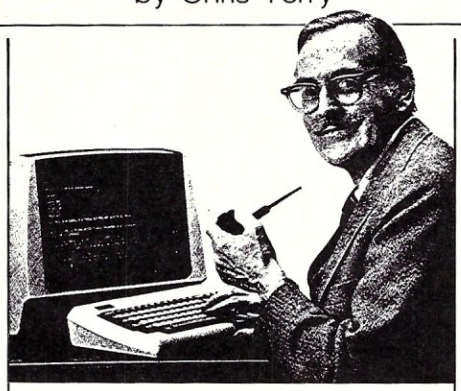
CIRCLE 193 ON READER SERVICE CARD

Editor's Page

by Chris Terry

While at the Fall COMDEX in Las Vegas, I attended a breakfast hosted by Digital Research, Inc. (DRI), at which Gary Kildall and his colleagues discussed both new products released or shortly to be released, and also the company's long range plans. In the short term, the two most interesting items were CP/M Plus, on which we have already started a series of articles, and the Graphics System Extension (GSX).

I shall not dwell here on CP/M Plus, except to say that the enhancements included in it are so radical that internally it no longer bears much resemblance to the earlier versions—it is for this reason that DRI christened it "CP/M Plus" rather than "CP/M 3.0." The user will be able to run most programs that were designed for CP/M 2.2—the exceptions are utilities or application programs that access and manipulate directories or make direct BIOS calls; these will probably not run without considerable modification. But anyone who implements CP/M Plus in a banked environment will experience a speed increase of four to ten times: the more memory is made available for directory hash tables and disk buffers, the greater the increase. But speed is not the only benefit to be obtained; a concept which greatly extends the functionality of the BDOS is that of the Resident System Extension (RSX), which is also being used to enhance Concurrent CP/M-86. An RSX is a special type of program that can be attached to the operating systems to modify or extend its operations. An RSX can be loaded below the operating system and can intercept console commands, rather in the same way that DDT works. A number of commands (e.g., SAVE) that used to be built in are now implemented as RSXs and are resident only when specifically requested. This makes for more efficient use of main memory.



GSX is an operating system designed specifically for graphics work, aimed at achieving portability of graphics programs at the object code level by the use of standardized function calls and standardized ways of performing primitive graphics functions. We shall be speaking more about this system, especially in an issue later this year that will have graphics as the main theme.

In the long term, DRI plans to port all of the languages and facilities currently available for CP/M-80 not only to CP/M-86, but also to CP/M-68K. This has led to an interesting development. The conversion of CP/M from the Z80 environment to the 8086/8088 environment proved much more difficult than had at first been expected, which was largely the reason for delayed introduction of CP/M-86. The situation became even more acute when creating a version for the 68000 CPU was proposed. An implementation in 68K assembly language was first envisaged; however, not a single programmer on their staff was willing to undertake such a monumental task. Thereupon, DRI started experiments with several high-level languages. A full implementation was done in Pascal, for example. By that time it was becoming evident that many 68000 systems would be supplied with UNIX or one of its derivatives, so that the use of C would have evident advantages. And in fact, the CP/M-68K operating system is written in C, right down to the BIOS level; very few routines absolutely required assembly language—there are fewer than 500 lines of assembly language code in the final system.

The use of C has given DRI the advantage of further portability, allowing them to move very quickly to new processors. The Z8000 version of CP/M was also implemented in C, only the Z8000-dependent areas having to be changed. CP/M-68K and CP/M-Z8K will include a bundled C compiler and a C runtime library. This will allow software developers to port programs written in C for a UNIX environment to CP/M-68K and CP/M-Z8K environments with relative ease.

As a comment on future developments, the DRI spokesmen put forward the view that UNIX is basically an old technology—the current direction of operating systems is messaged-based, using semaphores and multitasking. UNIX has not gone that way and thus, convenient as UNIX is for some purposes, more modern operating systems that follow the present-day mainstream may well be able to provide even better facilities for microcomputers, especially in the commercial sector.

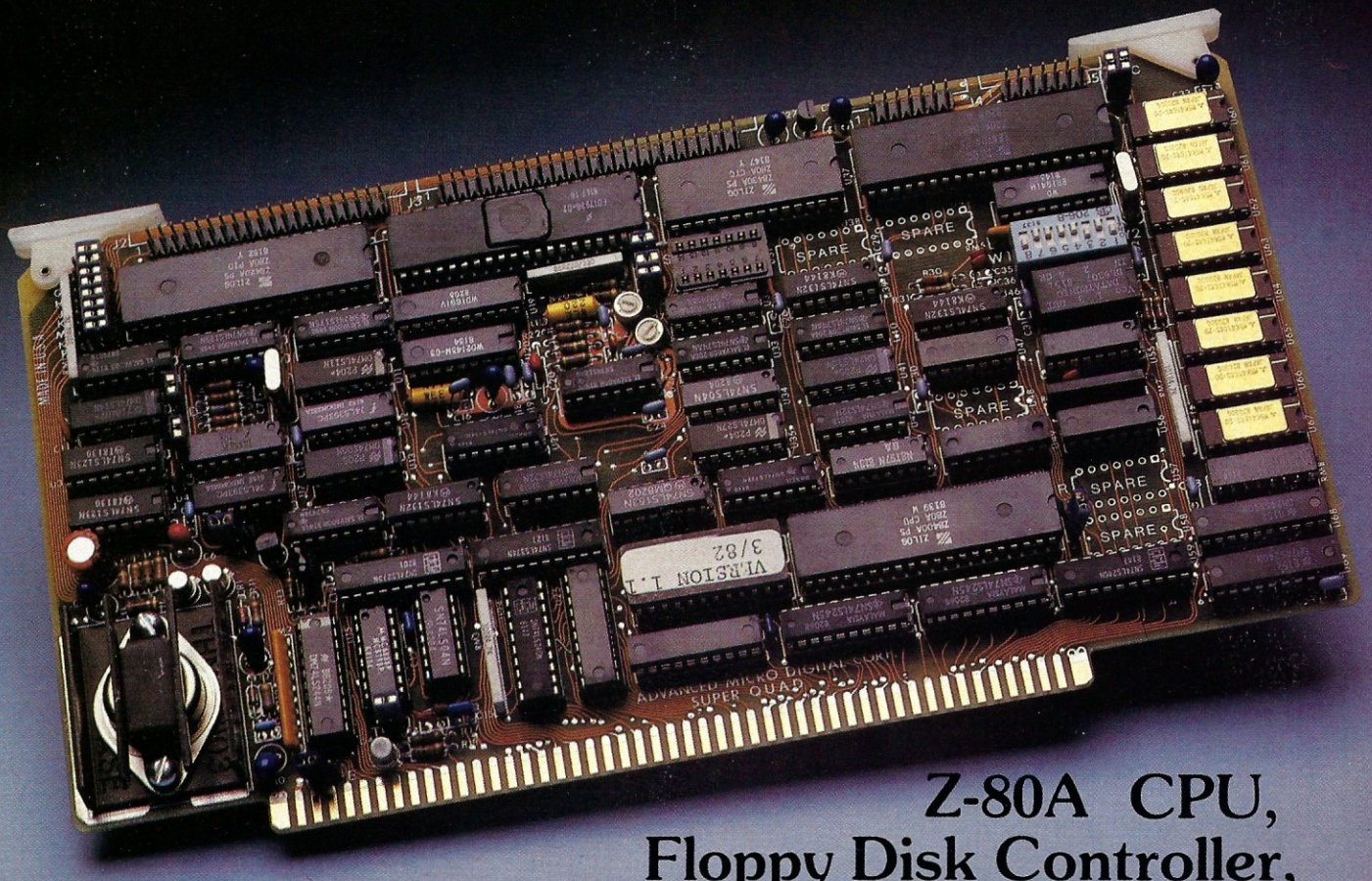
Other systems

Although our main focus will continue to be CP/M and the hardware that supports it, we have no intention of ignoring other systems. Our Nov/Dec 1982 issue introduced some material about MS-DOS, and our January issue was largely devoted to UNIX. We would be glad to consider articles on other operating systems also.

Public domain software

Microsystems has always strongly supported the organizations that disseminate software put into the public domain, and I am starting a column highlighting the sources and the important programs that are available. The first column appears in this issue.

Chairman of the Boards



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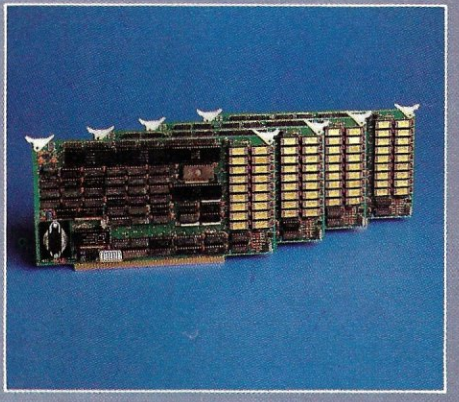

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CIRCLE 148 ON READER SERVICE CARD

News & Views

by Sol Libes

Random rumors

Osborne is expected to introduce the Osborne-2 this month. They have been keeping this unit under tight wraps, so no details are available. However, we suspect that it will continue to have a 5" display and a hard disk, be as small as the Otrona, and weigh about 15 lbs..... There are rumors that Mattel will introduce a CP/M based system this summer selling in the $600 range.

User group on-line systems

Both CPMUG and SIG/M, the two most popular CP/M public domain software user groups, maintain interactive computerized bulletin board systems. SIG/M has had theirs in operation since their inception in early 1980, while CPMUG has just initiated theirs.

The SIG/M RIBBS (Remote Interactive Bulletin Board System) is operated by Bruce Ratoff and can be reached by calling (201) 272-1874. In addition to the bulletin board, it contains about 3MB of SIG/M software available for downloading. The entire SIG/M library is maintained on a second RIBBS system having a 10MB hard disk drive. This system is operated by Bill Earnest; to reach it call (215) 398-3937.

The CPMUG CBBS (Computerized Bulletin Board System) is operated by Ward Christensen and can be reached by calling (312) 849-1132. This system also contains all of the CPMUG catalog files, which are available for downloading.

All three systems operate 24 hours a day, seven days a week, and are single-user systems, so please be considerate about the time spent on them. All three use PMMI modems and hence can operate at 100 to 600 baud. Press return until the system detects your speed.

New public domain software releases

CPMUG has not released any new software this month.

SIG/M has released eight new volumes, bringing their total up to 83. The new ones are:

Volume	Description
76	Software Tools from the CP/MUG of Australia
77	ZCPR 1.6—An enhancement to replace the CP/M CCP
78	More Software Tools from CP/M UG of Australia
79	PL/I-80 User's Group Library, Volume I
80	More Software from the Pascal-Z User's Group
81	More Software from the Pascal-Z User's Group
82	Complete JRT Pascal from Pascal-Z UG
83	More Software from CP/M UG of Australia

See page 20 for address.

DRI sets up CBBS

Digital Research Inc. has set up a Computer Bulletin Board System for use by purchasers of DRI software. The phone number is (408) 649-5186. The system is running on an Altos 8000-10, using CP/M version 2.2. It has one 8" floppy drive and one 8" 10MB Shugart hard disk drive The system is operating at 300 baud, 8-data bits, 1 stop bit, no parity.

DRI classes the system as "experimental" and calls it the "Computerized Software Performance Report System." DRI says: *"The intent is to provide an additional method for ISVs and others to report suspected software bugs and to review patches developed by Digital Research to correct known technical problems.*

"Callers may leave a message on the 'bulletin board' at any hour; these messages carry the same weight as a personal telephone contact with a technical analyst. At the Technical Support Center, all communications are reviewed daily and messages are routed to the appropriate personnel. Response to the inquiry will be appended to the user's message, typically within 24 hours of the original call. The caller then may telephone and reread his message followed by DRI's response.

"Use of the system requires entry of a valid and registered DRI serial number with the appropriate code; assistance is available from Technical Support, (408) 375-6262."

"RAM Cards Review" update

Two of the suppliers of the RAM cards reviewed in the January issue have informed us of revised specifications for their products. The CompuPro RAM-16 and RAM-17 boards are now being delivered with 6116-2 CMOS chips and improved decoding circuitry that yields better than 10 MHz performance with 8086-type processors and better than 6 MHz performance with the Z80, both with no wait states. Their CSC boards are rated at 12 MHz. Also, the prices of the RAM-16 and RAM-17 have been reduced to $550 and $449 respectively.

Electronic Control Technology has informed us that their 64K RAM card is now being delivered with CMOS parts, reducing power consumption and raising speed and reliability.

Errata

Jeff Duntemann's review of Pascal MT+ (Feb '83) was written some time ago. DRI has drastically revised its licensing agreements; there are now no royalty charges for inclusion of the runtime libraries of Pascal MT+, CB-80, or PL/I-80. We apologize for any inconvenience the error may have caused.

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Letters to the Editor

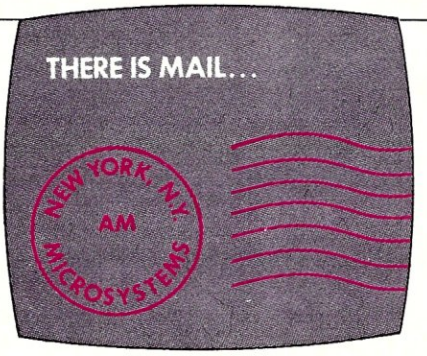
Sir:

Just a brief note concerning my hardware review of the Morrow Designs M26 hard disk system (Nov/Dec 1982).

Two items of information will be helpful to your readers:

First, somehow my fairly large table of the available hard disk systems was cut embarrassingly short. I spent a considerable amount of time compiling this survey; it is, none the less, somewhat superficial. I have enclosed a complete copy of this table so that you could print it.

Second, I have received a



fair number of requests for my software that adds on to your current BIOS and permits the addition of either the M26, M20, or M10. Here are the requirements needed to implement the Generic BIOS:

1) First of all, you need some experience with Z80/8080 assembly programing. This BIOS upgrade should not represent your premier engagement to *any* assembler. . . .

2) . . . which brings us to the type of assembler you need use. The mnemonic coding was ten as four macros designed to: install equates (I/O ports, command masks, etc); install the "Disk Parameter Block" values; place the actual driver routines at the end of the floppy routines; and finally, to set aside

Table 1. Comparisons between S-100 hard disk systems

Company	Product name	Hard disk used	No. of drives/ MB per drive	I/O type	Suggested list price	Meets IEEE Std?	Comments
Morrow Designs[3]	M26	Shugart SA4008	4/26	I/O mapped	$ 4,300	Yes	Many units installed
	M20	Memorex 102 Fijitsu 2302	4/20	I/O mapped	$ 3,900	Yes	
	M10	Memorex 101 Fijitsu 2301	4/10	I/O mapped	$ 3,300	Yes	
Konan Corp.	SMC-100	Control Data 9448 & others[4]	4/32, 66,96	DMA	$ 9,800-$12,500	Yes	Much OEM use; on market >2 years
	DGC-100	Seagate ST-506[1]	2/5-21	DMA		Yes	Diagnostics & error correction
	David	CDC Finch	1/5,10,21	I/O[2] mapped		Yes	8" floppy, too. Controller board w/ S-100 interface.
Ades	Gypsy	Priam 8" & 14"	4/8,32	I/O[2] mapped	$ 6,500	Yes	Tape control, intelligent
	S33	Priam 8" & 14"	4/33	Memory mapped	$ 5,000	No	Sold by Tarbell as well
Xcomp Inc.	X/S series	Many SMD, SA-1000, ST-506	4/Varies	Memory mapped	$ 2,500	No	Two-board set

1. The Seagate ST-506 has become the 5¼" interface default standard, with Tandon, Shugart Associates, BASF, Miniscribe, CMI, and Rotating Magnetic Memories all using the same interface convention.

2. These systems use a standard controller adapted to the S-100 bus via an I/O card with a parallel interface.

3. Morrow Designs has since announced a series of S-100 TMA controllers that use the Shugart SA-1000 and Seagate ST-506 type drives.

4. The SMD interface, used by "big boys" is also used by Konan in their SMC series.

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Oasis Systems
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*All items marked with an asterisk are available for the IBM PC

Letters to the Editor continued . . .

required disk driver RAM space. Macros are written in the Digital Research/Intel manner. Converting to another format would be fairly simple.

3) Of course, you need a copy of MAC®. Another, more tedious manner that avoids buying MAC (I encourage the purchase of MAC, a fine DR product) is to merge the single macros in the correct location of your current BIOS. This is very feasible because the hard disk macros are simple.

4) You must have a Z80 CPU, or be able to decipher Z80 instructions permitting the Generic BIOS to run on a 8080 machine.

5) The Generic BIOS will not drive any of the DMA type controllers.

Enough said—the cost of a floppy and S&H make the nonprofit, reimbursement cost $10.

Several people have sent me notes agreeing that the documentation included in the Hard Disk was inadequate. Several individuals passed on opinions that, if anything, the quality of the information was lower than the picture I painted.

Finally, I would like to encourage individuals who own or have installed any of the I/O mapped devices (M10, M20, or M26) to write, call, or leave a message on MicroNet, etc., concerning topics of interest to hard disk owners. I will pass these on. Of special interest are: S-100 boards that have been found to be incompatible with the M-series drives; interrupt-driven hard disk routines with the M-series; helpful software tools; and others. I plan to send information on the last two categories to anyone genuinely interested; drop me a note if you wish to receive any.

Paul H. Earley, M.D.
Earley Associates
2904 SE 28th Ave.
Portland, OR 97202
(503) 231-7719

Dear Sir,

Microsystem's readers may be interested in the following idea for enhancing their standard CP/M-based computer systems.

When configured for 8-inch single-sided single-density disks, CP/M reserves the first two tracks (track 0 and track 1) for the operating system, and the first 16 logical sectors on track 2 for the disk directory. It allocates the remaining disk space to files. The remaining disk space, ten 128-byte sectors on track 2 plus 26 128-byte sectors on tracks 3 through 76, totals 241.75K. File allocation is done in 1K increments, however. Therefore, on a standard CP/M disk there are 0.75K, or six sectors, that are never written to or read from by the operating system.

The unused sectors are physical sectors 18, 24, 4, 10, 16, and 22 on track 76 (assuming the standard sector skew factor of 6 is used), corresponding to the last six logical sectors on the disk. These sectors can be very useful for BIOS expansion, disk ID, data encryptation, or other systems-level functions. If they are used for BIO expansion, the cold-start loading and sysgen procedures must be appropriately rewritten.

Robert H. Lurie
8 Tingley Road
Morristown, NJ 07960

Gentlemen;

I think your magazine should be commended for giving the small software vendor a chance to bring his product before the public.

I also like your new magazine format. Keep up the good work.

John G. Ellis
Digital Color Corporation
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Editorial correspondence is welcomed; please address letters to Chris Terry, Technical Editor, Microsystems, One Park Avenue, New York, NY 10016.

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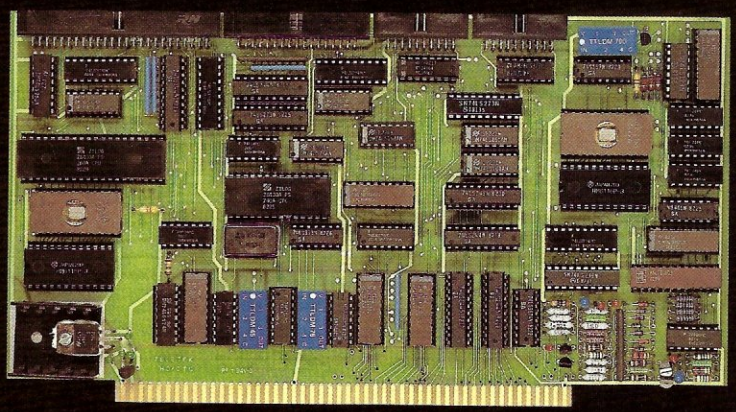

A hard disk and cartridge tape controller together on one board? Magic? Not really. It's Teletek's HD/CTC. The hard disk and cartridge tape drive controller provide the support necessary to interface both rigid-disk drives and a cartridge tape deck to the S-100 bus.

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- Support of 5¼" rigid-disk drives with transfer rates of 5 megabits per second. Minor changes of the on-board components allow the support of other drive types/sizes and transfer rates up to 15 megabits per second. (Interface to disk drive is defined by software/firmware on-board.)
- Controller communications with the host processor via 2K FIFO at any speed desirable (limited only by RAM access time) for a data block transfer. Thus the controller does not constrain the host processor in any manner.
- Two 28-pin sockets allowing the use of up to 16K bytes of on-board EPROM and up to 8K bytes of on-board RAM.
- Individual software reset capability.
- Conforms to the proposed IEEE-696 S-100 standard.
- Controller can accommodate two rigid-disk drives and one cartridge tape drive. Expansion is made possible with an external card.

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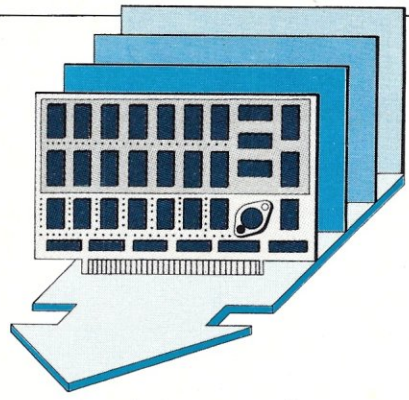
CIRCLE 220 ON READER SERVICE CARD

The S-100 Bus

by David Hardy

This month I am going to discuss some of the letters that I have received from *Microsystems* readers. Interestingly enough, two-thirds of the letters that I've received have been from outside of the U.S. About half have been from Australia or thereabouts, and many have come from Canada.



The first letter comes from Phil Cogar (P.O. Box 364, Narrabeen, NSW, Australia, 2101). Mr. Cogar suggests that an S-100 Bus column might be dedicated to explaining how it is possible to use "extended addressing" S-100 memory with CP/M. He also mentions that he'd like to see an article or two about the mechanics of interfacing a Winchester drive to an IEEE-696 CP/M system.

The latter suggestion would probably be best covered by an entire feature article, or perhaps even a series. Since that is a bit beyond the scope (or at least the size) of this column, I will set the Winchester aside, and try to touch briefly on the use and function of IEEE-696 extended addressing.

Basically, the question can be broken into two parts: First, how does the S-100 bus perform extended addressing, and second, how can CP/M use it?

The IEEE-696 (S-100) bus performs extended addressing by dedicating eight previously unused lines for use as address lines A16 to A23. Although these lines are optional on permanent bus masters, they are required on temporary bus masters. These eight additional lines can be used to select a slave board or to specify a memory location. (Note: The IEEE-696 bus now also allows an additional eight lines for I/O to allow 16-bit I/O addressing.

Extended addressing can also be used to replace the older method of using "banked-memory," which was basically just a way to select memory in chunks up to 64K by sending a control byte out to an I/O port.

How all this additional memory can be used in CP/M is really up to the programmer. Because CP/M is written for an 8080 processor, it can only directly use up to 64K of memory. Of course, an applications program could switch different banks of memory in or out (or use address lines A16-A23), but it would have to return to its "base" 64K chunk of memory before it could talk to CP/M. MP/M uses bank-switching quite effectively to achieve a multiuser, multitasking CP/M-like operating system. CP/M Plus (which is Digital Research's CP/M version 3.0) *does* allow more than 64K of memory, although, like MP/M, it is still used in 64K banks of up to 64K that are selected by the CP/M 3.0 BIOS.

In other words, versions 2.2 and earlier of CP/M do not use banked memory or extended addressing, but will tolerate it under certain conditions. For example, extended addressing can be used to implement a virtual disk, where perhaps a megabyte of RAM is used to simulate a disk drive, and the BIOS tricks CP/M into thinking that it is talking to a drive. I have also seen some graphics displays that use extended addressing to allow access by the CPU to the video RAM that is read to form the CRT image. The uses of extended addressing under CP/M are limited only by your imagination, as long as you respect the requirements of CP/M.

In closing his letter, Mr. Cogar mentions that he bought a CompuPro System Support I board with a 9511 Math Processor Chip that he is unable to use, because he has no software for it. I mention this in the hope that anyone who has implemented software for this IC might contact him, as he has been unable to find any either from Godbout or other sources.

Letter number two is from Ron Morrison (171 E. Sunset Blvd., Cannon Beach, OR 97110). In his letter, Mr. Morrison states that he has a multiuser Northstar system running Northstar's TSS/C operating system with four 64K banks and one 32K bank of memory. He wants to expand his system's memory (as he has only a 48K TPA or so available in each bank) to allow him to run a large database program.

In addition, he would also like to add DMA disk controllers to his system, and change to a dual processor (8085/8088) board to increase his memory addressing ability to greater than 64K.

Mr. Morrison says that "I keep hearing that none of this is possible with my North Star but get no reasons that hold water." Mr. Morrison (who is the owner of a home improvement/hardware store) also makes a rather interesting "hardware" comparison: "(If) I can put GE breakers in a Murray breaker box, why doesn't the (S-100) "standard" extend hardware and software to a level that allows someone to expand their system without starting all over again with a whole new computer?"

Well, maybe you can put GE breakers into a Murray box, but I'll bet you can't fit Push-Matic ones in there! Unfortunately, the same is often true with S-100 machines. Although they are all generically S-100, they are not all IEEE-696 compatible.

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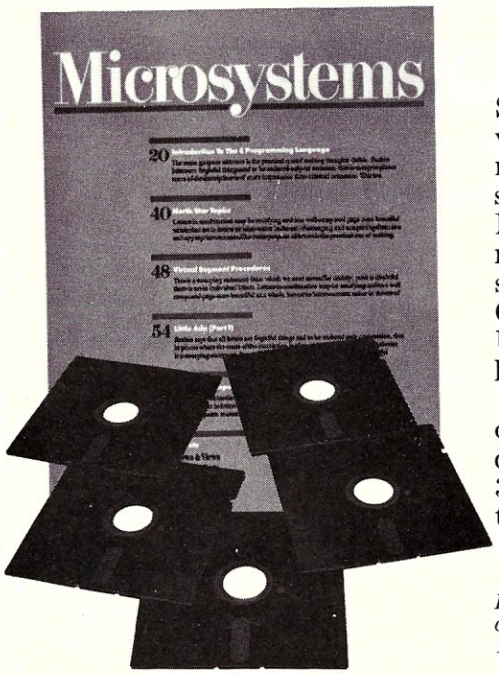

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frame) are not IEEE-696 compatible, you may not be able to use certain other S-100 (IEEE-696) boards. Most of the S-100 machines around today do not meet the IEEE-696 standards, which weren't even proposed until 1979. Is your machine IEEE-696 compatible? I believe that it is not, although the differences may be small. The only surefire way to see if any given board will run in your system would be to haul out the circuit diagrams for all of your existing S-100 boards, and compare them with the diagrams of the board you want to install. This can be *much* more complicated than it sounds because of the S-100 bus timing. The "quick and dirty" way is to just try the board in your machine, then check your system's operation, and the board's operation.

Since you are talking about replacing most of your system, including the CPU and disk controllers, making your machine IEEE-696 compatible may not be too difficult. However, changing the hardware so dramatically will also require an equally dramatic change in software. I am not familiar with the TSS/C operating system, but it will almost certainly not run on a 16-bit 8088 processor.

As far as the IEEE-696 standard extending the hardware and software levels of S-100 systems is concerned, bear in mind that IEEE-696 is a *hardware* standard. It's not really concerned with what software is used, just how the hardware works (or, more specifically, how boards are interfaced to the S-100 bus).

I'm sorry I can't be more specific, but this should at least give you an idea of the problems you may encounter. It can really be very difficult to "mix and match" boards that are not all IEEE-696 compatible, especially when dealing with boards that perform DMA.

Letter number three is from Michel Hanse (58A Leduc, Ste.-Therese, QUE, Canada J7E 2V8). Mr. Hanse writes: ". . . I am a hobby computerist and I am equipped with a TRS-80 Mod 3. Before that I had a TRS-80 Mod 1. Here is my question: Do you think it would be possible to interface my Mod 3 with the well-known S-100 bus?"

He also asks: "I would like to own an S-100 system especially to put an 8-channel synthesizer in it (SSM Blue boards) and maybe to create a bulletin board for our TRS-80 owners' club. What do you recommend?"

Interfacing an S-100 bus to a TRS-80 Model III would be impossible without having access to all of the address lines, and at least some of the control lines. Since, as you mention in your letter, the Model III has only an I/O bus for external connections, you'd have to "break into" the cabinet to get to the proper signals. You can't go through the "expansion bus connector" that the Model III has, because it contains only those signals necessary to perform buffered parallel I/O, and a few miscellaneous signals, such as a reset output and a bus interrupt request line.

Interfacing the Model III to a complete S-100 machine via

its expansion connector, however, would be fairly easy, and simple. The expansion bus can be treated as a simple parallel I/O port, which could be connected to a parallel I/O port from an S-100 machine. The handshaking lines are also available from the expansion connector. Parallel data could then be sent from machine to machine. Because the expansion bus also supplies I/O address information, you could actually implement several ports between the two machines. The model III makes the first 128 port addresses available for external use.

If you are interested in building your own interface to the Model III, you will find the following two books *very* useful: *The S-100 and Other Micro Buses* (second edition) by Elmer C. Poe and James C. Goodwin (published by Howard W. Sams & Co.), and *Interfacing to S-100/IEEE-696 Microcomputers* by Sol Libes and Mark Garetz (published by Osborne/McGraw-Hill).

About what I would recommend for use with a music synthesizer and a BBS: If you plan to use the same machine for *both* functions, then I could recommend virtually any IEEE-696 machine. (But make sure that the SSM boards that you have will work in it!) You'll probably need at least 8 slots, unless you use a single-board S-100 computer, in which case you could get by with 5 or 6. Whatever mainframe you get, make sure that the motherboard is actively terminated and will work up to at least 6MHz—preferably up to 10MHz. Godbout (among others) is already shipping 10MHz boards, for example, so you may as well buy a frame to match. Also, make sure that it has a good clean power supply. A constant-voltage power supply is a nice feature, too, if your local power company has occasional "brown-outs."

Unless you enjoy hardware hacking, make sure that all of the boards that you buy will work together. Of course, IEEE-696 compatibility is a must, but check, too, that there will be no other conflicts or problems, like, for example, overlapping I/O ports. Many I/O-mapped disk controller boards can't be remapped without an X-Acto knife.

To run a BBS, you will also need a modem. The PMMI modem is a good choice for a plug-in S-100 board. It is a 103J type (0-300 baud) modem, but works well up to 600 in many cases. It is not yet available as a 212A (1200 baud). For external use (that is, for connection to a serial port), you might try the Racal-Vadic 3451 series "triple" modem that works in 103J, 212A, and in Racal-Vadic's own 1200 baud standard. There are lots of different modems available; I mention the above two only because I use them myself.

Please keep the letters coming in (even if they are only gripes, ideas, or recommendations). I'm also collecting "horror stories" about troubles that people have had with different boards or manufacturers for a future column, so if you have any, please drop me a note.

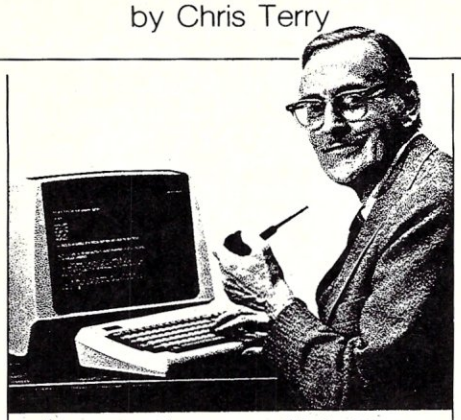
In the Public Domain

by Chris Terry

Do you know about the public domain software libraries? If you belong to one of the computer clubs, then you probably hear about the new volumes that are added every month. But I am constantly amazed at the number of readers who call me to ask advice on a mailing list package or a database or some other useful program and, when I mention CPMUG or SIG/M as a source, say "What are those? How do I find out what's in them?" In fact, there are now (around Christmas) nearly 200 volumes of fascinating language compilers (six versions of Basic and 13 other languages), utilities, assemblers, mailing list programs, database packages, and games available to you. Think of it, that's around *forty-eight megabytes* of almost free software! And there will probably be another 10 to 20 volumes by the time you read this.

To you who have been old hands since the days (around 1975) when the woolly Altair roamed the tundra and Tyrannosaurus IMSAI mangled your fingers as you keyed programs in through the front panel switches, I make no apology for spelling out once more the facts of microcomputer life that you started absorbing at your first club meeting. There seem to be a lot of otherwise savvy people who are only just getting into the microcomputer world and haven't gotten the message yet. For their benefit, this column will give highlights of what is out there.

To begin at the beginning, then, there are two separate libraries of programs that run under CP/M-80: The oldest is the CP/M User's Group (CPMUG) library, organized by CACHE (Chicago Area Computer Hobbyists Exchange), assembled and duplicated by Lifeboat Associates; and Special Interest Group/Microcomputers (SIG/M), which is a joint venture of the Amateur Computer Group of New Jersey and the New York



Amateur Computer Club. The addresses of CPMUG and SIG/M will be found at the end of this column, but the preferred method of obtaining disks is through your local club, where you pay only the cost of the media plus a small copying charge (usually $1 per volume) which goes to the club to defray the cost of mailing and other incidental expenses.

Right here I want to pay tribute to all the people who have contributed their programs and hard-won knowledge to these libraries, and to the many other people who have given so much of their time to grouping related or similar programs conveniently on disks, and copying and distributing the disks for the benefit of club members and the public at large.

Make no mistake, computer users and the microcomputer industry in general owe these people a very large debt of gratitude—just as the radio industry and users owe a similar debt to the work of the hams. And I want to make very clear, because I feel strongly about it, that all of these public-domain programs are *learning tools*. Most of the later contributions will run under CP/M 1.4 or 2.2—I use many of them almost daily. Others were developed for CP/M 1.3 and are hardware-sensitive; you may have to adapt them to your system, or you may have difficulty in using them at all. But you get the source code, which is reasonably well commented (excellently in some cases). Reading this source code and figuring out the changes necessary to make it run on my system has been one of the finest learning experiences I could ever have wished for.

I was horrified when at one club meeting people complained that some programs had bugs in them and that there was no way of knowing whether a particular program would do exactly what the enquirer wanted. These people were making unreasonable demands on those who have done so much to make the software available at all. They were unwilling to spend a mere $5 per disk—thus denying themselves hours of exciting and richly rewarding exploration and learning. Take a chance! What you get may not be *exactly* what you want, but you will have a lot of fun finding out. Plus, you'll have the opportunity to pay your debts either by active participation in your local club, or by passing on the fruits of your experience to other people.

A word or two on how to find out what is in the libraries. SIG/M periodically publishes a catalog of all the SIG/M volumes with a one-line description of each program or related group of programs in each volume. The last issue is dated October 1982. It covers up to SIG/M Vol. 75, and it is available at $1 through your local club or $1.50 by mail from SIG/M. And the New York Amateur Computer Club has published three volumes (Book 1; Book 2, Part 1; and Book 2, Part 2) of catalogs. The NYACC volumes cover both CPMUG and SIG/M disks up to and including CPMUG Vol. 79 and SIG/M Vol. 60. They include hard copy of documentation supplied on the disks, together with brief reviews of some of the software. Book 2, Part 1 also contains an alphabetical index of all programs in CPMUG up to Vol. 52, and in SIG/M up to Vol. 42.

The list does not end here. There is a C Users' Group, a Pascal-Z Users' Group, and other similar groups, all of

Public Domain
continued . . .

which have libraries of public-domain software and distribute it to their members at nominal cost. I shall be mentioning these in future columns. The next installment, however, will be devoted to language interpreters and compilers, of which there is a rich assortment.

CPMUG volumes are available from:

CPMUG
1651 Third Avenue
New York, NY 10028

SIG/M volumes and catalog are available from:

SIG/M User Group
Amateur Computer Group of New Jersey, Inc.
Box 97
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Combined catalog is available from:

S-100, CP/M User Group
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The UNIX File

by Ian F. Darwin

The UNIX File is scheduled to appear every other month. It will focus a spotlight on important aspects of UNIX. If you have questions about UNIX, send them in and I will attempt to answer them.

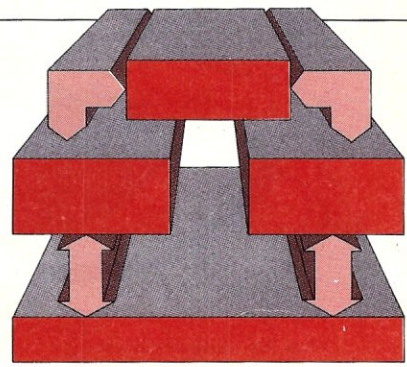
UNIX isn't CP/M

UNIX is rearing its streamlined head from every corner of the small computer market. Many are predicting that UNIX will become "the CP/M of the 80s" in terms of being a standard for the small computer user.

Since many of the readers of *Microsystems* are very familiar with the CP/M operating system, I thought it would be of interest to compare UNIX with CP/M-80 2.2, (since few of you will have gotten CP/M 3.0 up and running yet), pointing out a few areas where they differ as well as the relative strengths and weaknesses of each. I'll look at three areas: the user interface, add-on utilities, and document preparation facilities. If my coverage appears biased, remember that this is the UNIX column, not the CP/M column. There are many other areas to compare, some of which may surface in future columns.

The user interface

The user interface is that which stands between you and successful use of the computer. A clean interface lets you do your work with a minimum of hassle; a poor interface hinders you at every turn. I use the term "user interface" for the programs with which a user has frequent contact, the way these programs behave, their ease of use—in short, what you have to put up with to get your job done using a computer system. The CP/M user interface is patterned after an early version of Digital Equipment's RT-11 operating system, while that of UNIX is patterned partly after that of MULTICS and CTSS, and partly in reaction to those



of a number of other manufacturers.

The RT-11—and hence CP/M—user interface is patterned on the traditional data processing model: You run a single program, then it asks you what to do, then you tell it what to do, then the program tries to do what it was told. If there's further processing, you run another program, and it asks you what to do . . . .

The UNIX user interface is patterned after the model of 'tools' or building blocks, which are used together to combine into more powerful tools. For example, UNIX has a single program to list information about your files (CP/M has DIR for some information and STAT for others). The program does not know how to print today's date, nor the free space on a disk, nor how to summarize columns, nor anything else—it just lists the files in a directory. To get a summary, you can connect the program (called "LS") to a line counter program—the number of lines in the LS output IS the number of files, so

```
ls | wc -l
```

will tell you how many files are in your directory. The operator "|" means "run two programs at the same time; feed the output from the first in as the input to the second." Similarly there's a program to search multiple files for a character string, called "grep". The command

```
grep "abc" *.t
```

will show every place that "abc" occurs in all ".t" (which I use for text) files in your current directory, while

```
grep "abc" *.t | wc -l
```

will just tell you how many places the string "abc" occurs in all your text files.

Add-on utilities

One measure of an operating system's completeness is the library of utilities with which it is provided. CP/M comes with a very crude editor ED, a simple assembler ASM, PIP for copying files, and a DUMP program that only decodes and displays files. You cannot use DUMP for directories, because "files" and devices are considered as quite different objects under CP/M, even at the system call level. Trying to dump a disk's system tracks with the command

```
DUMP A:
```

gives a message "NO INPUT FILE PRESENT ON DISK"; it's reassuring to do a directory on the disk to see that your files are still there! This works on RT-11, and it *ought* to work on CP/M from a consistent point of view. UNIX, by contrast, provides a consistent structure; programs usually do not know or care whether they are accessing a file or a device.

CP/M also has a SUBMIT utility for performing files of commands, MOVCPM and SYSGEN to relocate or copy the operating system, and a machine-language debugger called DDT. Built into the system are the command interpreter, the DIRectory, REName and ERAse commands, and a few others. There's also a transient directory command called STAT, used to change a file's status, to see how big the file is or to see how much free space is left on a disk (DIR knows how to list files, but not how big they are). CP/M does not come with a screen editor, a sort/merge program, a macro assembler, a compiler, a text formatter or a database management system. If you want any of these on CP/M, you'll have to pay extra for them. (Editors' Note: *CP/M Plus, at*

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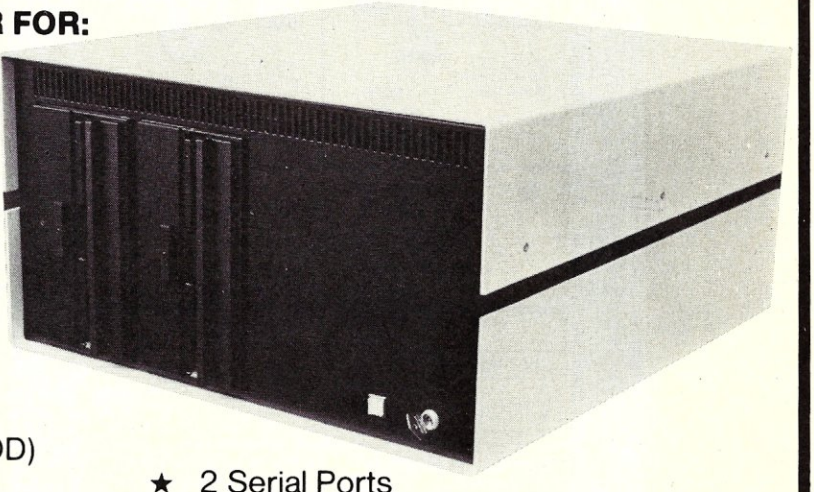

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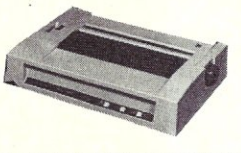

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UNIX File continued. . .

$350, includes absolute and relocating macro assemblers (MAC and RMAC), a linkage editor (LINK-80), a library builder (LIB.COM) and the enhanced debugger SID.)

There are no built-in commands in UNIX. Indeed, the command intepreter or "shell" is a user program and can be replaced by the knowledgeable user. Standard UNIX comes with a CP command to copy files, MV to move or rename them, usually two or three editors (including a powerful line editor and a full-screen editor), a simple assembler, one or two macro processors, a debugger and compiler for the 'C' language (roughly equivalent to a Pascal compiler in power and value), a text formatting and typesetting package, MAKE for maintainance of interdependant programs or other files, a text sort/merge, a dump program that dumps files or whole devices in octal or in ASCII, an electronic mail system, an intermachine file transfer (**uucp,** which the electronic mail system knows how to use), a self-teaching package (LEARN), online reference manual (MAN), program development tools (YACC, LEX, etc.) database management primitives (DMS(III)), and a whole range of other software. This is all included in the standard UNIX configuration (with variations for V7, Berkeley, System III). It's also included in Mark Williams' UNIX-alike, "Coherent." Some, but not all, are included in Whitesmith's IDRIS.

Of course there's nothing free in this world. While the cost of buying CP/M with all this software exceeds the cost of buying UNIX, you can't expect to run UNIX on a 2MHz 8080 with 20K of memory and one single-sided 5" floppy disk. Nobody's quite sure of the absolute minimum, but it's probably something like 96K and two 8" floppies—this is the configuration which I think IDRIS B/80 supports. V7 UNIX has been developed to the point where it probably wants 256KB of memory and a hard disk to be usable for program develop-

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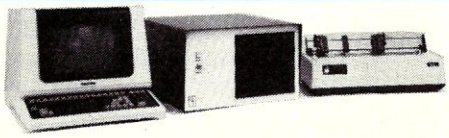

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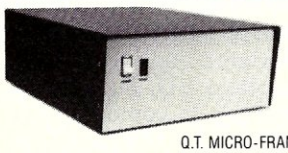

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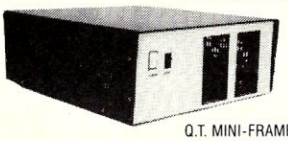

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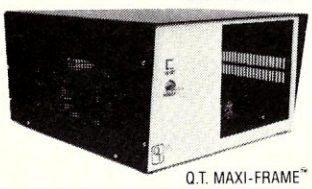

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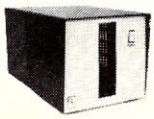
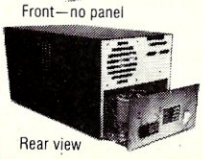


Front—Tandon Panel

Front—no panel



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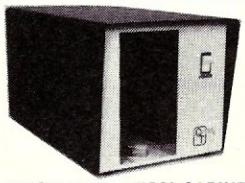

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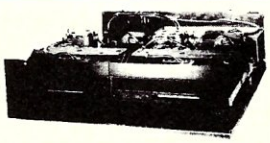
Size: 11″H 11″W 18″D

Perfect add-on disk drive for any system. Accepts most brands.

QTC-DDC8V $299



DUAL 8″ HORIZONTAL DRIVE CABINET

Dimensions: 5″H 17″W 20″D

Designed to provide basic disk storage capacity for S-100 and other computers. Low profile permits table top stacking.

QTC-DDC+88H $349

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CIRCLE 30 ON READER SERVICE CARD

UNIX File continued. . .

ment. And, unfortunately, a few UNIX systems—such as DUAL Systems' System 83—have extra cost for the files needed to reconfigure the operating system for new devices. Standard UNIX from Bell Labs includes these files.

Some people have claimed that there is more software available for CP/M than for UNIX. However, a lot of the public-domain software for CP/M is just there to fill gaps in the system! The public domain software for UNIX consists of useful items such as a spreadsheet package, electronic mail interfaces, bibliography packages, and so on. Most of the UNIX public-domain software is written in higher-level languages such as C and is therefore movable from machine to machine, while a lot of the CP/M public domain programs are written for the 8080/Z80 machine and cannot readily be moved to the 16-bit machines.

Document preparation

The line-oriented editor on UNIX is called ED, but has next to nothing in common with CP/M's ED. UNIX ED is a powerful line-oriented editor with a much better syntax as well as the ability to split and join either lines or files without the need for such kludges as those of CP/M's ED. If you want to merge files with the eidtor, CP/M makes you rename files to "x.LIB", then reenter the editor to read them in. UNIX ED allows reads or writes of full or partial files at any time without leaving the editor. For the case where you do have to leave the editor to do something, there is a "command escape" in ED (as in most UNIX programs) to let you run any other program without abandoning what you're doing. It's common to answer short mail items while remaining in the middle of an edit session, for example. This sort of thing is possible only on a multiprocessing system (UNIX is inherently multiprocess and multiuser)—but once you're used to it you wonder

how other people get along without it.

Berkeley versions of UNIX also come with a screen-based editor called "vi", for "visual." Vi has its limitations, but it uses one nice feature of Berkeley UNIX, the 'TERMCAP' facility. This is a series of functions and a database describing about 200 common CRT terminals and the characters needed to control them. When a new terminal arrives, you just define it in the Termcap language (if it's not already listed) and all the programs—screen editors, spreadsheets, screen print programs—know how big the terminal is, how to clear its screen, move its cursor, and so on. "TERMINFO", a new facility currently in preparation at Bell Labs, builds on and extends the TERMCAP facility. The UCSD p-system has had a primitive screen capability facility for many years. Yet CP/M comes with no such facility, and each application must usually be customized to the terminal's characteristics.

CP/M comes with no text formatter. UNIX, as has been mentioned, comes with a text formatter and a typesetting language called **nroff** and **troff** respectively. Commands are embedded in the text file, with some special character (initially a period) at the beginning of control lines. It's not a full-screen word processor such as WordStar, or a stand-alone such as Wang or Lanier/AES or others might provide; it's considerably more powerful, although some say it's more work to learn. Technical papers are routinely typeset from UNIX using the same imbedded commands used to produce drafts on the line printer; some books have also been typeset in this fashion.

An important aspect of UNIX vis à vis document preparation is that the wide range of tools used in program development is directly applicable to text processing. WC counts words of text (useful to authors!) as well as it counts lines of program code. Grep searches for names of people as well as it finds names of variables. SORT sorts names and addresses of people as well as it sorts numeric data. And UNIX has had spelling checkers (one using a dictionary, another using rules derived from the particular text being checked) for years before the current flash of spelling checkers on CP/M. In fact, UNIX was originally promoted as a text-formatting system in 1970.[1]

Full-screen word processors are available for CP/M and UNIX. The problem with some of them has been the use of "control" characters for commands. This imposes a strain on the typist's fingers, as there's only one control key on most keyboards (there are two shift keys). With the advent of terminals with auxilliary keypads, such programs are starting to use keypad keys instead of control keys. Because of TERMCAP, these programs

UNIX File continued. . .

will be easier to adapt to new terminals under UNIX.

UNIX is very well suited for the development of programs that take text files as input. Spelling checkers are one example. As another example, consider a program to count and print all two-character combinations used in a text. This would be useful to linguistics researchers, to people considering ways of compressing English text, and others.[2]

I wrote such a program, from a fragment in the LEX manual, in about 20 lines of source code. The collection part is two lines; the rest is code to print the table, plus a few comment and declaration lines and a few blank lines for neatness. Building such a program in CP/M assembler would be very tedious, to say the least.

There is a bibliography package called REFER that cooperates with **nroff/troff** to produce bibliographies for books and papers. You simply embed a few keywords about the article in the place where you want the reference to occur, and then REFER looks them up in a bibliography list and generates the detailed references in one of several standard forms. It also prints the cited works in a bibliography at the end of the paper. A companion program LOOKBIB looks up the references interactively for quick location and checking purposes.

Berkeley UNIX has programs STYLE and DICTION to analyse an author's writing style. I haven't used them yet, but the documentation tells us what they do. STYLE reads a text and calculates several standard "reading difficulty scores" as well as a number of other statistics. DICTION looks for overused or commonly misused words and phrases in a document. Programs of this complexity would be very difficult to develop without the wide range of program development tools with which UNIX is endowed.

Summary

I've looked at the UNIX and

CP/M systems from several points of view. CP/M has a simple user interface; UNIX provides a more productive and consistent one. CP/M provides some utilities and an assembler; UNIX includes an assembler and a compiler as well as a very comprehensive set of utilities and program development tools. CP/M comes with no text formatting tools; UNIX includes text formatting and typesetting, and the UNIX programming tools work well in document preparation.

My next column will feature some "applications programs" written in UNIX—without any programming.

Notes

1. For the history of UNIX, see "The Evolution of the UNIX Time-Sharing System" Ritchie, D.M., *Proceedings of the Symposium on Language, Design and Programming Methodology*, Sydney, 10-11 September 1979, pp. 25-35. Springer-Verlag, 1980; *Lecture Notes in Computer Science*, 79.
2. For information on this and similar programs, see McMahon, L.E., Cherry, L.L., and Morris, R., "Statistical Text Processing," Bell System Technical Journal, Vol. 57, No. 6, July-August 1978, page 2137.

Errata

The "Unix File" column in our January issue contained several errors. The *Microsystems* staff ran an early draft of the column (not realizing that it was preliminary), without the author's having a chance to see it.

Unfortunately, the names of the UNIX developers were switched. To set the record straight, Ken Thompson is the real father of UNIX. Dennis Ritchie and Brian Kernighan worked with Thompson in the early development of the system. Thompson and Ritchie developed the system, and co-authored the original paper describing UNIX, published in CACM. Ritchie developed the C language. Kernighan co-authored (with Ritchie) the book *The C Programming Language* and (with Plauger) the books *Software Tools* and *Software Tools in Pascal*.

In addition, references to 'BSD 4.1' should be '4.1BSD', and so on. UNIX was first built on a PDP-7, not a PDP-11. And versions 5.0 and PWB 1.0 were released to the outside world. (Version 5.0 from the early 70s should not be confused with the recently announced UNIX System 5, which is a 1983 product. The names System III, System V (or System 5) derived from "Unix Support Group System III" and 5; this group is now called the Unix Development Laboratory.)

Microsystems apologizes to the individuals named above for any inconvenience this may have caused.

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SOFTWARE REVIEW

WordStar
Shining in the Software Firmament

The ins and outs of a well-known word processor

by Steve Leibson

I can't type. This may seem a strange way to start a review of a word processing software product, but it really isn't. Those of us who never learned to type need a word processor even more than those who do.

Typists do not make nearly as many mistakes as nontypists. It's the mistakes that take all the time. When I made an error on the typewriter, I had to roll the page up, paint on an opaque white solution, wait for it to dry and finally roll the page back down to where I stopped. Many times, the paint wouldn't dry quickly enough, or I would miss the place where I had stopped typing. Thus one mistake could easily be compounded by staggered lines or a large white splotch in the middle of my text.

Revolution

The WordStar word processing package has revolutionized my communiction skills. Errors are simply eradicated with the press of a delete key. This is only a minute fraction of the power placed at my disposal, however.

WordStar is a screen editor. The computer screen replaces the typed page for composing. WordStar shows you *exactly* what will be printed when you finish. This includes showing you where the page will end and how the characters will fall on the line. Many word processors do not show page breaks, and final copies can end up with dangling sentences at the end of a page or tables split in half by a page break.

Automatic word wraparound is another feature that aids the typist and nontypist alike. You need not be concerned when nearing the end of a line. WordStar will split the sentence between words and carry the next word to the start of the next line. No carriage returns need to be entered except to end paragraphs.

WordStar will left- and right-justify text. Normally, I use both left and right justification for articles, but turn off right justification for personal letters. It makes the letter look "hand done."

These are just a few of the features that make WordStar easier for me to use than a typewriter. I have been able to improve both the quantity and quality of my reports and articles because of this amazing piece of software.

Choosing a product

I had a North Star Horizon computer for seven months before purchasing WordStar. When I started my publishing house, Data Press, I wrote my first book using a text editor that was part of an assembly language development system. Text editors, as opposed to word processors, are character-oriented instead of word-oriented. They don't know about words, sentences or paragraphs. They count characters or lines. A line is a string of characters that ends with a carriage return, though a line feed is usually added automatically.

Although I managed to type my book into the computer using the text editor, I vowed never to do it again. This started my search for a good word processor and printer.

There were several requirements that I wanted my word processor to meet. First, it had to be compatible with my computer, the North Star. This didn't eliminate many software packages because the North Star can run several operating systems, notably the North Star Disk Operating System (DOS) and CP/M.

Second, the software should be able to take advantage of the rest of my hardware. This includes a memory-mapped video display and a keyboard with extra, user-definable function keys. Also, I wanted a printer that would produce high-quality text that could be used as camera-ready copy. Since my system did not yet have a printer, the word processor would have to handle as many different types of printers as possible.

WordStar fills these requirements very well. As it turned out, I bought both the word processor and the printer at the same time at the Computerland of Denver. The only way I was able to decide on WordStar was to take the operating manual home for an evening, so a local dealer was important to me. A thorough reading convinced me that WordStar could do what I wanted.

Bringing up the system

Installing WordStar is a breeze. You must have CP/M running *reliably* on your computer before trying to start up WordStar. A balky operating system will destroy text files and possibly ruin your program.

All parameters that WordStar requires for operation are entered once using the INSTALL program supplied. This program steps you through a series of menus. A selection from each menu is made and when INSTALL has finished, WordStar has a complete description of your system which it uses to modify the WordStar program that you will run.

The first Terminal Menu is displayed as:

Steve Leibson, 4040 Greenbriar Blvd., Boulder, CO 80803

```
      *****  WordStar TERMINAL MENU #1  *****

A Lear-Siegler ADM-3A          C Lear-Siegler ADM-31
D Hazeltine 1500               E Microterm ACT-IV
F Beehive 150/Cromemco 3100    G IMSAI VIO
H Hewlett-Packard 2621 A/P     I Infoton I-100
J Processor Tech SOL / VDM     K Soroc IQ-120
L Perkin-Elmer 550 (Bantam)    Z None of the above
2 Terminal Menu #2
```

Terminal Menu No. 2 looks like this:

```
      ***** WordStar TERMINAL MENU #2 *****

M Microterm ACT-V              N Televideo 912
O Visual 200                   P Flashwriter I
Q Flashwriter II               R SWTPC CT-82
S Compucolor 8001G             V TEC Model 571
1 original menu                Z none of the above
```

By entering the letter corresponding to your terminal, INSTALL places the necessary software routines in your version of WordStar to make that terminal work. Cursor addressing is used extensively in WordStar to update the text display and menus.

That is why the program has to know what type of terminal you have. Each terminal requires a different sequence of characters, called an Escape sequence, to position the cursor on the terminal screen and to turn on inverse video or other display enhancements for highlighting.

I have added some software to my memory-mapped video to make it work like a Soroc IQ-120. Though WordStar worked with this setup, I found a much better configuration. WordStar knows about memory-mapped video displays.

My video board, a Vector Graphics Flashwriter II, is on Terminal Menu number 2. Unfortunately, the standard Vector Graphic's configuration requires the Flashwriter to be addressed at D000 hex in the computer memory. My Flashwriter is at E000 hex, so I could not use the standard INSTALL selection.

MicroPro has done an excellent job of documenting the terminal and printer drivers, so I had no trouble patching in my board. That is because I can program in assembly language and understand much of the inner workings of my computer. It is not a job for the novice.

The computer store from which you buy your software should be able to help you if you have problems. It might be best to assure yourself that they have the expertise and willingness to help before you buy from them. If you buy your software by mail order to get a better price, be sure to buy the software configured for your system (with a *guarantee* of operation or money back), or have someone standing by who can help you—otherwise be ready for an ulcer. MicroPro has made the configuration as painless as possible, but there is no substitute for an experienced computer programmer who can find the way around inside the guts of your computer, just in case.

The next menu presented is the printer menu. Printers supported are: generic "Teletype-like" printer, printer with a backspace capability, Diablo 1610/1620, Diablo 1640/1650, Qume Sprint 5, NEC Spinwriter 5510/5520, printer with "half-line-feed" capability or a printer driven by the MicroPro I/O Master interface board. Just as with terminals, MicroPro has provided you with a large group from which to choose. I can't think of any printer that isn't included in this list.

Except mine. I bought a NEC Spinwriter 5525. This printer appears to the computer as a Diablo 1610/1620, but it has some extra features. After carefully reading the printer documentation, I decided to configure WordStar for the Diablo 1610/1620. As mentioned for terminals, if you have a printer listed in the menu you will probably have no problem with INSTALL. Otherwise, have someone knowledgeable standing by.

The next menu is the "Communications Protocol Menu." Printers that connect to computers over a serial link commonly exhibit a problem. Though characters can be transferred to these printers at up to 960 characters per second, most printers print the characters at a slower rate. Somehow, the computer has to be told to stop sending for a while until the printer catches up.

A mechanism called handshaking is usually used to do this signaling, but the "standard RS-232C" serial interface doesn't really have handshaking. Many printer manufacturers violate the standard by using some of the RS-232 signal lines for a handshake, but such use in a printer doesn't guarantee that the computer will violate the RS-232 standard in the same manner. Violations are not standardized!

A more complex handshake is performed when the printer sends a character to the computer requesting a pause in the transmission of characters. Later, when the printer catches up, it sends another character to the computer to start transmission again. Two sets of characters are commonly used for this purpose. They are ETX/ACK and XON/XOFF. Neither of these handshakes is standard.

WordStar can understand either of these character handshakes. You can also tell INSTALL that the handshake is to be done by other software or hardware and not to be concerned with handshaking. I had already implemented a hardware handshake in my computer, so I told INSTALL to forget about handshaking.

This brings us to the last INSTALL menu, the Driver Menu, which lets WordStar know how to send characters to your printer. Options are: as the standard CP/M "List" device to a parallel output port somewhere in the computer, or using user-installed subroutines.

The easy way out is to use the CP/M List device if your printer is already connected and working with your computer. Otherwise, you'll need the

aid of a software specialist again.

Finally, INSTALL provides a "patcher" that allows you to directly access the code byte by byte. Thus you can put in your own machine language routines or set up other options that are explained in the back of the manual. This procedure definitely requires the services of a programmer if you need special options set up.

As you can see, there are quite a few things to tell WordStar about your computer. I think MicroPro has done an excellent job creating a way for one piece of software to be used on virtually any system. I have now INSTALLed WordStar several times and each time I get a slightly better, easier-to-use system.

Working with WordStar

Since reading the WordStar manual before purchasing the software and installing it, I have not read it again. The only reason I can do this is because of the extensive use of menus displayed on the screen. The upper half of the computer display lists of all the commands available.

Commands are issued by using control characters. This is done by holding the "control" key down on the keyboard while pressing a letter key simultaneously. But for first entry of the text, you don't need commands—you can just type.

When WordStar is started, it provides a very clear menu of the different operations that can be performed. The menu looks like this:

```
D=create or edit a Document file          H=set Help level

N=create or edit a Non-document file      X=eXit to system

M=Merge-print a file                      P=Print a file

F=File directory off (ON)                 Y=delete a file

L=change Logged disk drive                O=cOpy a file

R=Run a program                           E=rEname a file
```

Beneath this menu, a file directory is listed, if the directory is turned on. The F command has an alternating action that turns the directory display off if it is on and on if it is off. Usually, I press "D", which starts the document editing process.

WordStar asks for the name of a file to edit in response to a "D" command. If you give a name of a file that already exists, WordStar assumes you want to edit that file. A backup file is automatically created so if you make a severe error, only the edits entered during the current editing session are at risk. The backup file holds the text as it appeared before you started.

Restoring the file is as simple as renaming the backup file. All backup files end with the suffix ".BAK". WordStar will refuse to edit any file ending in ".BAK", thus protecting you from your own gross negligence. If the file name given to WordStar for editing doesn't exist, a file with that name will automatically be created. This is how you start new files.

I have found this system to be nearly foolproof. In two years, I have never lost a file due to the program or my own clumsiness—and I have been pretty clumsy at times.

One item listed in the menu may puzzle you. Just what is a "nondocument" (main menu option N)? It is a text file with no special print formatting such as right justification or print enhancements. Program source files are best edited as nondocuments to prevent WordStar from placing non-ASCII codes in the text file. Non-ASCII codes tend to give assemblers and compilers indigestion and are best avoided.

Control codes

Though you can enter a first draft by just typing normally, the real power of the program is in the use of control codes to make your corrections. They are represented on the screen as an up-arrow followed by a letter such as "^A". Though two characters are displayed, a control character is a single character in the file.

The cursor can be moved around on the screen with "^S", "^D", "^E", "^X" representing left, right, up and down respectively. Also, "^A" and "^F" stand for move left and right by one word. These control characters allow you to walk the cursor around the screen to wherever you need to edit. Text will automatically scroll as you try to walk the cursor off the screen.

This way, you never need to be concerned with how to get the portion of the file you wish to edit to appear on the screen. If you move the cursor in the proper direction, the text of interest will eventually appear.

Screen editing in this manner is very natural. I frequently think of something I should have written in a previous paragraph, walk the cursor up to that point, add in the extra words and return to where I was. Even though I can't type, I can get the words into the computer almost as fast as I think them!

The control characters "^C" and "^R" cause a full screen to scroll by, up or down. This allows quick movement through the text. A "^G" is a backspace, which is the same character as a backspace on most keyboards. The same is true for "^I", which is a tab. A ruler just below the menu and above the text shows where the tab stops are. WordStar has absolute tab stops as opposed to relative tab stops. This is how typewriters have their tabs.

Normally, WordStar starts up in the insert mode. Characters are always being inserted into the file wherever the cursor appears. A "^V" will turn insert off. Then any characters typed will replace characters already on the screen. A box in the upper right of the screen tells you whether insert is on or off. The "^V" will change the status from off to on and on to off. I usually work with

Installation is a breeze . . . menus presented by the INSTALL program make it easy to tell WordStar everything it needs to know about your system.

the insert mode on.

Prefixes

Five control characters are prefixes. They allow you to do some really fancy things to your text. Whenever a prefix control character is entered, the main menu disappears and a submenu takes its place. This submenu shows what operations are possible through that prefix. If none of the operations are desired, pressing the space bar will cancel any prefix.

A "^P" (control P) is the print prefix. The next letter typed after the "^P" will determine a print control that will be inserted into the text. Some of these are:

- **S** *underScore toggle: this is entered before and after text that is to be underlined.*
- **B** *Boldface toggle: this is entered before and after text that is to be printed in* **bold** characters.
- **D** *Double-strike toggle: similar to boldface but the characters aren't as dark.*
- **X** *Strikeout toggle: indicates that the characters between two strikeout toggles will have dashes printed over them. This is useful to indicate deleted text in a revised document.*
- **V** *Subscript toggle.*
- **T** *Superscript toggle.*
- **Y** *Ribbon color toggle.*
- **A** *Alternate pitch.*
- **N** *Standard pitch.*
- **Q, W, E, R** *User-defined printer functions.*

When a print control character is inserted into a text file, it appears as a control character. Thus **bold** looks like ^BBOLD^B in the text. This is necessary because most video displays are not capable of displaying the wealth of print enhancements possible with WordStar. Naturally, if a printer is not capable of printing an enhancement, WordStar will not be able to either.

The "^O" prefix is called the format prefix. With it you can set margins, tab stops, center text automatically and control how the display appears on your screen. The tab stop ruler can be turned on or off. The directory can be called up or deleted from the display, and word wraparound, justification, and the page-break display can be turned on and off.

The "^Q" prefix is for commands. There are commands to take the cursor to the beginning of the file, the end or to any of 10 markers that can be placed in the file. These markers can be placed with the "^K" prefix, followed by the number fo the marker (zero through 9). This prefix also allows you to do block operations such as move or delete marked blocks of text. Markers are not saved with the file when it is saved on the disk.

Finally, the "^J" prefix makes several help aids available. Explanations of most of the WordStar control characters are stored on disk. The "^J" prefix can call these onto the screen at any time without disturbing the text. "^J" can also be used to eliminate the menu or submenus for experienced users who prefer to see more text on the screen.

Fine tuning

Since the control character commands are always on the menu, memorization of the special control keys is not required. I like to have my system running as smoothly as possible, however, and decided that the special function keys on my keyboard would be quite useful for replacing the control keys.

There is a block of memory in WordStar allocated to user-supplied machine code routines. I put a special keyboard routine there that intercepts the keycodes. If the key pressed is a normal key, it is passed on to WordStar. If it is a special-function key, however, the code is transformed into a control key and then passed on to WordStar for processing.

This way, I can turn off the main menu and still not have to memorize control keys. I also tied in my cursor control keys for moving the WordStar cursor around on the screen.

And dots not all

Another type of text enhancement is possible with dot commands. WordStar takes advantage of the fact that periods are never used at the beginning of a line. If a period does appear at the beginning of a line, it is interpreted as a dot command. There are commands for setting line height (.LH), paper length (.PL), top and bottom margins (.MT and .MB) as well as for controlling page numbering and text headings or footings.

A special feature of WordStar is real-time recognition of dot commands. The far right column of the video display is usually blank. Text normally only uses the first 65 columns. When entering a dot command, WordStar will recognize the period as the start of a dot command and place a question mark in the far right column of the display. The question mark will not disappear until a recognizable dot command has been typed in. This syntax checkng is very useful. You don't have to wait until the text is typed to see if the command is a proper one. Some word processors will type an error message during the printing of your file if an improper dot command is found. Unfortunately, by then it's too late to fix the error for the current printout.

The dot commands are the only Word Star features not explained in the submenus or the "J" command. There is a list of these commands in the back of the manual, however. That's the only part of the manual I use now.

WordStar does not hide text, or confuse me with cryptic error messages.

Using WordStar

I have used WordStar for business and personal letters, addressing envelopes and writing articles such as this one. Letters are now fun because I can pull an old letter in from the disk, edit it and send it out. I haven't had to type my return address for months!

Envelopes are a little tricky because they don't look good unless the spacing is just right. I wasted about three envelopes before I got a format that pleased me. Now, I call in an old envelope file, switch off the insert mode and type the new address over the old one.

Articles are the most fun to do on WordStar. Even though I outline what I intend to write, I almost always think of extra topics to write about. It is very important for me to be able to go back and add to or refine what I wrote. In addition, I never worry about making mistakes because of the ease of editing.

An example of the power WordStar can provide is an article series I wrote. It was originally a series of 12 articles on computer interfacing, written over a span of two years. After typing these into WordStar, it took me only about three hours to read in four articles at a time, condense them, add in some linking paragraphs, and thus transform a series of 12 articles into a group of three. There is no way I could have done this without a word processor. I simply haven't the time.

In addition, I have used WordStar to create assembly language source files. It is much easier to use WordStar, a word processor, than ED, the text editor that comes with CP/M. I use the N option in the first menu (edit a nondocument) for this purpose.

Performance

WordStar lives in the CP/M environment on my North Star computer. It is thus constrained by the disk drive and CP/M file access speeds. I have not found that writing has been hampered too much by delays caused by this system. A large file can require several seconds in traveling from end to beginning, but it would take much longer with a typewriter.

Files are maintained on disk and need not fit in available memory. As you edit, a portion of the file you are working on is brought into memory, while older material is written back out to the disk. Thus the largest text file you can edit on my system is 250K. WordStar can take a source text file from one drive and create an edited file on another.

Fortunately, I have quad-density (360K) minifloppy disk drives. Text requires vast amounts of disk space, and double- or quad-density 5.25″ minifloppies or 8″ floppies are a must. The quad-density drives on the North Star are also faster than the older minifloppy drives, which is nice.

The amount of memory in your computer will determine WordStar's performance. You must have at least 45K bytes of memory to run WordStar. If you have more memory than the minimum, WordStar will not have to swap text between disk and RAM as often. Swapping takes time and is really the only relatively slow process in the system.

WordStar's interaction with the memory-mapped video is astounding! There is almost never a delay between typing and display, even when submenus are brought up or large portions of text are changed. The Soroc configuration was definitely slower. I think that a real word-processing system ought to have a memory-mapped display for performance. The only time I have to wait is when text is being transferred between disk and computer memory.

WordStar will drive my Spinwriter at full speed. The program allows the printer to print both forward and backward, so time is not wasted with carriage returns. Almost all of the features available on the Spinwriter are accessible through WordStar. It seems like a very good marriage.

One feature of WordStar that I never use is the ability to edit one file while printing another. This requires more memory and destroys system performance. Both editing and printing require the use of the disk drives, and printing gets priority. Thus the pauses during text paging off the disk become much longer. I find it less irritating if I ignore this feature entirely.

So far, I have experienced no program crashes due to software bugs. The only problems were due to a determined effort on my part to kill the program or occasional static electricity discharges. Static is just plain bad for computers, and MicroPro could hardly fight this problem.

There are always bugs

I have found WordStar to operate almost flawlessly. It does not hide text as some programs I have used did. It does not confuse me with cryptic error messages. Best of all, it does not lose files or turn them into garbage. The only time you really encounter problems is if you let your text disk get full. Then you may lose your edits, though you will still have your original file.

The only problem I have had was in trying to use special print controls that allow my printer to print special symbols. The manual says WordStar will support this if you patch a few bytes with INSTALL's patcher. Version 2.1 did not support the special symbols if they were the first characters in a line of text. Versions since 2.26 have not had this problem.

Another irritation, though not a bug, is MicroPro's *WordStar Customization Notes*. These notes tell you many extra things you would need in order to customize your WordStar. If you are a programmer, you are tantalized with mentions, in the installation chapter of the WordStar manual, of default locations for help levels, timeouts, and

I can get words into the computer almost as fast as I think them.

how to add special-function keys.

Unfortunately, these notes cost about $500. With the already high price of WordStar, I have not felt justified in paying more for these notes. I have either accommodated myself to what MicroPro set up or found other methods for making changes, such as the modifications I made for my keyboard routine.

WordStar's new features

Two new WordStar features added in version 3.0 are horizontal scrolling and column-mode operation. Also the menus have been reorganized for easier reading. Horizontal scrolling works just like the vertical scrolling of earlier WordStars. If the line is longer than the video screen, it extends past the right edge. To see the rightmost portion of the line, the entire page is scrolled to the left. Thus the screen is a window to a text file that is as long as your disk is large and as wide as 255 characters.

I use horizontal scrolling for working with documents to be printed at 12 pitch (characters per inch) where I get 90 characters per line. That doesn't fit on my 80-column screen, but with horizontal scrolling, it is quite easy to manipulate the wide text. Previously, WordStar would wrap the line around to the next, so that "What you see is what you get" was not really true. Now it is.

Column-mode operation is very useful. The intended purpose is to allow you to manipulate columns of text when making lists, and it does work well for this. I have found an even better use, however. In newsletter work, the 90 characters per line were hard to read. I now set margins for 40 characters per line, type in the text, reset the margins for 90 characters per line and then use the column-mode mover to create pages with two text columns, each with 40 characters per line. This electronic cut-and-paste works extremely well.

Recommendation

I believe that MicroPro's WordStar is an excellent word processor and a well-written program. It has a good user interface and provides a lot of features for the noncomputer type user.

There are so many features in WordStar that I have covered less than half of them in this article. WordStar can do just about anything with text except do the writing for you. If you are looking for a word processor, you should definitely consider WordStar.

The price of WordStar is $495; it can be bought through a worldwide dealer network. For further information contact:

MicroPro® International Corp.
33 San Pablo Ave.
San Rafael, CA 94903
(415) 499-1200

Note: *WordStar is a registered trademark of MicroPro International Corp.*

SOFTWARE REVIEW

WordMaster: More Than a Replacement for ED

A screen-oriented text editor

by Larry A. Thiel

The memory is kind of vague, but I seem to recall a guy named ED[1] who used to help me write source code for programs and even, on rare occasions, helped me write short text files so I could print them on my computer's printer. ED was a good friend, so he worked cheap (or maybe I should say that ED worked cheap, so he was a good friend). ED was reliable and got the job done, but he really wasn't too bright, so it took a lot of my time and effort to tell him exactly what I wanted done, and the same again whenever I needed to correct my mistakes.

Fortunately, I have met a new friend who goes by the very strange name of WordMaster[2] and is a great deal more intelligent than ED. WordMaster does not work quite as cheaply as ED, but he saves enough of my time to be well worth the additional cost. My new friend is so helpful I am afraid I have almost completely forgotten my old friend ED.

Seriously, WordMaster is a screen-oriented editor by MicroPro which runs under CP/M, is relatively powerful, very easy to use, much quicker than ED, and is not very expensive. The purpose of this article is not to be a tutorial on the use of WordMaster, but to explain what WordMaster is and what it can do. I will also show why WordMaster is a viable and reasonable alternative to other editors and word processors and for whom. WordMaster is not the ideal choice for everyone, but if it fits your needs, WordMaster may be the choice for you.

My system

I run WordMaster on an S-100 Z80-based system under a 56K CP/M operating system with two 8" disks and a Micromation double-density controller. The printer is immaterial, since WordMaster is not capable of accessing the printer. The terminal used is not a terminal at all, but a Xitan VDB video board with some custom driver software and an Electronics Warehouse keyboard.

The significance of this is that while most of the system is pretty standard stuff, my custom video board driver software does not emulate any terminal I know of. Therefore, WordMaster had to be more configurable than many commercially available programs.

Installation

WordMaster does not have an installation program as some products do, but I suspect that if MicroPro ever updates WordMaster again they will include one. WordMaster comes ready to use with any of the following terminals:

Lear-Siegler ADM-3A
SOROC IQ-120
IMSAI VIO-C video board and display

WordMaster does come with sufficient documentation to install it for just about any variation of console device. MicroPro provides instructions and assembly files so that DDT can be used to install WordMaster easily for the following terminals:

Beehive 150
Cromemco 3100
Hazeltine 1500
Processor Technology SOL computer
(or their VDM video board)

All is not lost if you do not have one of the above listed terminals (or something compatible with one of them). The assembly files can easily serve as models for any competent assembly language programmer to create patches to drive your console if it supports random cursor addressing, backspacing, and clear screen functions. WordMaster can be used in the command mode without these capabilities, but since its big advantage is the video mode, I would not recommend this.

Modes of operation

WordMaster has two modes of operation. Video mode is easy and convenient to use for most editing functions, but does not have the power available in command mode. Video mode lets you see what each keystroke does as you type it and is sufficient for most editing functions. Command mode is similar to using ED, but has a much more powerful set of commands. Unfortunately, command mode has one drawback—you do not automatically see the results on the screen as you do in video mode. Command mode is used for more specialized editing functions than are possible in video mode.

Video mode

Video mode is the great advantage held by screen-oriented editors over line and character editors such as ED. Screen-oriented editors display the text being edited on the terminal with the cursor placed somewhere in the displayed text. The cursor is effectively a pointer into the text pointing at the place where any operation requested will be

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performed. When the operator requests that an operation be performed, the text is altered on the screen so the operator can immediately see the effect(s) of what is being done (and what mistakes he is making).

WordMaster is used mostly in video mode for this reason. Video mode can be used with "insert on" or "insert off." When insert is on, printing characters input from the keyboard are inserted into the text between the character to the left of the cursor and the character the cursor is on. That character and any others to the right of it are shoved further to the right to make room.

When insert is off, any printing character input replaces the character the cursor is on. Control characters input from the keyboard (by pressing the control key and another key simultaneously) are used for moving the cursor around in the text and for performing minor editing functions. The cursor can be moved within the text by a character, word, line, or screen at a time. Editing functions include deleting characters, words, and lines and inserting blank lines and tabs. Sometimes the editing capabilities available in video mode are inadequate for the task you have in mind. Pressing the ESCAPE key will then put you in command mode, which has much more powerful editing capabilities than the video mode.

Command mode

The disadvantage of command mode is that you do not see the effects of your commands as you enter them. Command mode has commands to move around in the text, insert and delete text, find strings, find strings and replace them with others, and display text on the console. WordMaster commands are nearly identical with those in ED, which makes them easy to learn for people who are used to ED.

MicroPro has added some extensions and features to the ED command set that greatly enhance the power of the command mode. Searches and substitutions do not have to search for a specific string; the string may contain wild card characters, inverse wild cards (match any character except), or generic separator characters. These can be very useful for things like selective substitutions for strings where you don't want the substitution to take place for all occurrences of the string.

WordMaster has a special buffer, the Q buffer, into which text can be placed. The Q buffer can then be used to insert that text elsewhere or as commands to be executed on request. WordMaster provides commands to read other files into the text and write text lines into other files in a fashion similar to ED, except that the file type can be explicitly named. Probably one of the nicest extensions involves the macro function.

Macros

Macros are a method of executing a set of commands some number of times. The whole set of commands is executed once and then executed again and again until the desired number of repetitions is completed. WordMaster allows macros to be nested, which means that almost any editing function (even complex ones) can be easily repeated any number of times.

A macro may have the V command (go to video mode) embedded within the set of commands that the macro executes. During execution of the macro, the V command will cause WordMaster to enter the video mode so the user can see what the macro is doing *and* do any video editing that seems necessary. WordMaster remembers the macro execution and resumes processing it when the user returns to command mode. This "interactive" execution of the command string gives the WordMaster user a great deal of flexibility not available in many other text editors.

The macro function and the ability to store a command string in the Q buffer can be very convenient. I keep a library of often-used macros on disk ready to be used any time I need them. I read this macro library into the file I am editing only once, and from that time on I can use any of those macros without having to reenter or rewrite any of them. All I have to do is put the desired macro into the Q buffer, go to the point in the file where I want to execute the macro and tell WordMaster to execute the Q buffer.

It is a simple matter, for example, to build an empty jump table in an assembly file and then just fill in the blanks instead of having to enter all the keystrokes normally necessary to build a jump table. When I have finished editing the file, it is just as easy to delete the lines of macro commands from the file.

Help is available

WordMaster has a help function available to the user at any time. The help display is several screenfuls of notes that the user may page through at will. WordMaster always displays the same help information without regard to what the user was doing when help was requested. Help information is displayed one screenful at a time, and after each screen the user may continue to the next screen or return to editing. I do not think the help screens are very well orgainzed. They are not easy

```
        VIDEO MODE SUMMARY  (type ^J for next frame)

^O   INSERTION on/off          RUB  Delete CHR LEFT
^S   Cursor LEFT char          ^G   Delete CHR RIGHT
^D   Cursor RIGHT char         ^\   Delete WORD LEFT
^A   Cursor LEFT WORD          ^T   Delete WORD RIGHT
^F   Cursor RIGHT WORD         ^U   Delete LINE LEFT
^Q   Cursor RIGHT TAB          ^K   Delete LINE RIGHT
^E   Cursor UP LINE            ^Y   Delete LINE (All)
^X   Cursor DOWN LINE          ^I   PUT TAB IN FILE
^^   Cursor TOP/BOT (^HOME)    ^N   PUT CRLF IN FILE
^L   Cursor RIGHT/LEFT         ^@   DO NEXT CHR 4X
^W   FILE DOWN 1 LINE          ^P   NEXT CHR IN FILE
^Z   FILE UP 1 LINE            ^V   VIO CONTROL
^R   FILE DOWN SCREEN          ESC  EXIT VIDEO MODE
^C   FILE UP SCREEN            ^J   DISPLAY THIS
```

Figure 1. *Old help screen No. 1*

WordMaster puts no control characters in the file unless you tell it to, and does not set high-order bits that confuse an assembler.

```
          VIDEO MODE SUMMARY  (type ^J for next frame)

CURSOR  ------------------------------------------------------------------
        ^S   left CHAR          ^D   right CHAR       ^E   up LINE
        ^A   left WORD          ^F   right WORD       ^X   down LINE
        ^B   right/left LINE    ^Q   right TAB        ^>   top/bottom PAGE

FILE    ------------------------------------------------------------------
        ^Z   up 1 LINE          ^C   up 1 SCREEN
        ^W   down 1 LINE        ^R   down 1 SCREEN

DELETE  ------------------------------------------------------------------
        RUB  CHAR left          ^G   CHAR right
        ^<   WORD left          ^T   WORD right
        ^U   LINE left          ^K   LINE right       ^Y   LINE (All)

INSERT  ------------------------------------------------------------------
        TAB   a TAB             ^N   a blank LINE     ^P   next CHAR

MISC    ------------------------------------------------------------------
        ^O   Insertion mode ON/OFF      ^J   Display this HELP file
        ^@   Do next key 4 times        ESC  Enter COMMAND mode
```

Figure 2. *New help screen No. 1*

to read or to reference for a single piece of information (see Figure 1).

Fortunately, the help screens are contained in a simple text file called WM.HLP and may be edited to a form you find useful. The only thing you must be aware of to edit the help file is that a control Q in the data file is used by WordMaster to stop the screen display for pagination of the help display. I have presented my modified help display in Figures 2 through 5 as an example and as a guide to the commands and functions of WordMaster. You should note that I have changed some of the commands to reflect the requirements of my keyboard.

What is WordMaster good for?

I use WordMaster mostly for creating and editing assembly language source files. I also use it to create tables for reference use and forms to be printed and filled in by hand such as order forms and work logs. I occasionally use WordMaster to create prose type text for processing by an inexpensive text processor, since I do too little of this type of work to justify the cost of a full-blown word-processing package.

I prefer to use WordMaster for assembly language editing because WordMaster will not put any control characters in my file unless I tell it to, and it will not set any high order bits (like some word processors) that can screw up my assembly. Another advantage of WordMaster is that it can edit a rather large file entirely in memory, which is much faster when I have to jump around in the file a lot or when I wish to make a lot of global changes.

System requirements

WordMaster requires a CP/M system with at least 20K of memory and at least one disk. The system console must be capable of random cursor addressing, cursor backspacing, and have a clear screen function. Systems with more available memory will be able to edit larger files without disk buffering. WordMaster can edit a 40K file entirely in memory on my 56K system.

Full WordMaster operation requires enough disk capacity to hold two copies of the edit file plus about 16-20K, depending on the system and the operations to be performed. WordMaster is capable of editing a file of over 100K on any system that has 8″ disks.

Frankly, anyone who edits such a large file without a dire need has a lot to learn. It is much easier to edit small files and then put them together when the editing is done. With a 64K system and 90K disks, you can still edit a file about 45K long, since the whole text file will fit in the memory buffer and disk buffering will not be needed.

WordMaster problems

I cannot say that I have found any bugs in WordMaster. I have found a couple of potentially irritating features, however. If you tell WordMaster to quit the current file (abandoning any changes you have made), WordMaster erases the old backup file copy. I am sure this is because WordMaster erases it when you begin the editing session so as to use less disk space. I do not consider this an important flaw.

WordMaster provides no recovery procedures for "disk full" errors and the like, so it is very important that you save your work every 20 or 30 minutes to avoid loss of too much work if an error should occur. This is a good procedure anyway, because you never know when a power failure or something might destroy your work. You can feel very foolish if you haven't saved your work for four hours and must do it all over again.

However, a "disk full" error is not necessarily fatal. If you receive this error, try to end the session. If that does not work, and you have a two-disk system, try writing 100 lines to a file on the other disk and then delete them from the current file. You should then be able to end the session normally and put the pieces back together later.

While executing a command mode macro that contains the 'V' command, it may not be possible

```
          COMMAND MODE SUMMARY  (type ^J for next frame)

+-nC    Move n CHARACTERS       +-nD   Delete n CHARACTERS
+-nL    Move n LINES            +-nK   Delete (Kill) n LINES
+-B     Move beg/end FILE
+-n@    Move n LINES & type 1   +-nP    Move & type n PAGES
+-nT    Type n LINES            nZ     SLEEP n SECONDS

nItext$         INSERT text n times
I@              Enter INSERT mode (ESC or ^Z exits mode)
nAtext$         APPEND - do 1L then just like nItext$
A@              APPEND - do 1L then just like I@
n<....>         LOOP:  repeat <....> n times (default n = 65535)
M....$          LOOP:  repeat .... 65535 times
^C              EXIT loop whenever necessary

*-----------------------------------------------------------------*
|   +-  means   + or - allowed here, + assumed if omitted         |
|   @   means   Carriage return or line feed necessary here       |
|   $   means   ESCAPE or ^Z or carriage return necessary here    |
|   n   means   a number, 1 assumed if omitted, # = 65535         |
*-----------------------------------------------------------------*
```

Figure 3. *New help screen No. 2*

The video mode is easy and convenient to use . . . the command mode has macro facilities that allow complex commands to be executed any number of times.

```
        COMMAND MODE SUMMARY  (type ^J for next frame)

+-nFkey$          FIND - short search for key n times
+-nNkey$          NEXT - long search for key n times
+-nSkey$text$     SUBSTITUTE - replace after short search n times
+-nRkey$text$     REPLACE - substitute after long search
/F,/N,/S,/R       as above, except exit <..> or QX if key not found

nQP         PUT n lines into Q buffer & delete from file
n/QP        APPEND n lines to Q buffer & delete from file
nQG         GET - copy Q buffer into file n times
QT          TYPE Q buffer on console
QK          KILL - clear Q buffer
QX          EXECUTE commands in Q buffer
QLtext$     (LOAD) PUT text INTO Q BUFFER
n/QLtext$   APPEND text TO Q BUFFER n TIMES

*--------------------------- LEGEND 2 ----------------------------*
|  ^N   CRLF inside text or key          ^Y  ESC inside text or key  *
|  ^A   match any char for key           ^S  match separator for key *
|  ^OX  match any char but X for key                                 *
*--------------------------------------------------------------------*
```

Figure 4. *New help screen No. 3*

to abort the command with a control-C. This happens when the macro enters video mode so frequently that you are not able to type fast enough to catch WordMaster while it is in command mode. The problem, of course, is that control-C is a different command to video mode. I can't complain that WordMaster is too fast, but I wish MicroPro had chosen a different control character to abort a command. This problem has been resolved by Trevor Marshall of Australia. Anyone interested in the solution is referred to Disk 42 of the SIG/M User's Group (see page 20 for address).

Most of WordMaster's shortcomings are more of the "Gee, it sure would be nice" variety. The Q buffer is so useful I would like to have several of them, and a few character or number registers to use in commands and macros. The Q buffer is also very useful for moving blocks of text, but it would be nicer to be able to mark a block and be able to move or copy it without use of the Q buffer in a manner similar to WordStar.

The ability to read an external file into the current text is very handy, but could be enhanced by a conditional read file command. Such a command would display the external file on the screen a screenful at a time and allow the user to ignore the screenful, or position the cursor and tell WordMaster to either start or stop using the external file at that point.

Some editors have an "UNDO" command that allows users to erase the effects of the most recent command. Such a command would be an excellent addition to the WordMaster repertoire.

The macro capability could be greatly enhanced by the addition of some conditional commands (for example: "insert if register *x* greater than *n*"). WordMaster should be capable of accessing the

```
  COMMAMD MODE SUMMARY  (type any key to return to editing)

Y[d:]name.typ$          YANK - reads file in at cursor
nW[d:]name.typ$         WRITE n lines into the file named

V   Enter VIDEO mode              n!   PUT Ascii code n into file
;   All following is COMMENT      E    END edit (normal exit)
H   END edit and EDIT again       Q    QUIT - abandon edit
O   Return to ORIGINAL file       ^Q   Display this HELP file
```

Figure 5. *New help screen No. 4*

WORDMASTER continued . . .

system printer to print the file or portions of it. This list could be continued forever with fancy items like split screens, windows to other files, etc., but I guess that is why there are more expensive editors.

Recommendation

If your needs are for a powerful and easy-to-use text editor that also happens to be quick, I do not know of another program I would recommend over WordMaster. You can always use a text processor for the occasional word processing need and avoid the high cost of a full word processor. However, if you need word processing power on a more than occasional basis, I would not recommend WordMaster unless you have a great deal of patience and time on your hands.

Notes

1. CP/M and ED are registered trademarks of Digital Research; ED is the line editor furnished as part of the standard CP/M package.

2. WordMaster is a registered trademark of MicroPro International Corp. The WordMaster package costs $150; version 1.07 was reviewed. Information can be obtained from:

MicroPro International Corp.
33 San Pablo Avenue
San Rafael, CA 94903
(415) 499-1200

Magic Wand– A Word Processing System

An editor plus a sophisticated text formatter

by F. J. Greeb

Just wave your Magic Wand and your words will appear printed exactly as you want them! It's really not quite that easy, but the Magic Wand software package will turn your microcomputer into a powerful and flexible word processing system. The package consists of two programs, EDIT and PRINT, and will run on almost any 8080 or Z80 microcomputer that uses the CP/M operating system. EDIT is a screen-oriented editor that features all of the commands required to enter and edit text material. The PRINT program is a text output processor that can print your text in almost any form imaginable. In addition to the normal features usually found in a word-processing system, the PRINT program allows the use of variables in the printed output, and for control of the printed output. These variables may either be internal parameters, read from the keyboard during printing, or read from a disk data file.

Installation

Bringing up Magic Wand (now called PeachText) on your computer system is extremely easy, since when you order the system you specify your terminal type, printer type, and disk format. When you receive the system, it is already tailored to your hardware. Just put the disk in your drive (be sure you have a backup copy) and you are ready to go. The latest version (PeachText 2.0) released by Peachtree includes a configuration program that allows the user to configure the program for a number of common terminals and printers, or for nonstandard peripherals.

I am currently running the system on a Xerox 820 computer, with two double-density minifloppy drives and a NEC Spinwriter printer. The Xerox 820 has a very fast memory-mapped video display and an interrupt-driven keyboard with a 16-character type-ahead buffer, which is an ideal combination for a word-processing system. I have also operated Magic Wand on an S-100 system, with a serial terminal operating at 9600 baud. The screen update time is slower on this type of system (about 2 seconds for a full screen), but is not unacceptable. Since Magic Wand frequently checks the keyboard status while doing screen updates, you do not have to worry about missing keyboard characters while the screen is being updated.

Editing a file

To edit a file you enter the EDIT command followed by the desired filename. The CP/M operating system will load the EDIT program, and it in turn will load your file. Before loading the file, EDIT will provide you the opportunity to change the disks in your drives. It is not necessary for the Magic Wand programs and your text files to be on the same disk. By reading your input file from one drive and writing the edited file to a different drive, it is possible to have a file that is as large as your disk capacity. Magic Wand will read the file until the entire file is in memory, or until available memory is nearly filled, and then will enter its command screen mode.

F. J. Greeb, 8403 West Iliff Lane, Lakewood, CO 80227

Command mode

The command mode displays the name of the file you are editing, the number of lines or paragraphs (denoted by carriage returns), words, and characters in the file, the program mode, line width, and the current tab settings. The command screen also displays the total memory available for editing, and the amount of memory currently unused. One advantage of having the EDIT and PRINT features contained in two separate programs is the larger memory workspace available for editing files. On the Xerox 820, which runs a 60K version of CP/M, the available memory workspace is over 40,000 characters. At an average of 2000 characters per page, this means that you can edit a 20-page document without having to page it into memory from disk.

When operating in the command screen you can enter commands that will affect the text file you are editing. Available commands allow writing all or a portion of the file from memory to disk, reading more data from the file into memory, merging a second file (all or part) into the file you are editing, text block manipulations, and CP/M file directory examination and file deletions. You can also print your file from the edit program, but any special formatting features that are handled by the PRINT program will not be in effect. You can also spool to the printer any file other than the one you are editing. In this mode, the printer is driven as a background task while you are working on your current task with the editor. Since the PRINT program will allow its output to be directed to a disk file, you can print a fully formatted text file while editing a different file. How well the spooling feature works depends on how it is implemented on your system. If you are running CP/M version 2.2 and the list status function is properly implemented, Magic Wand will use this feature to prevent tying up the system while the printer is busy. In this mode, spooling works quite well. If, on the other hand, the printer output status is not

tested, and the printer output routine is called when it is busy, it becomes very easy to miss keyboard characters during the spooling operations. With this form of implementation you will probably decide not to use the spooling feature.

Text screen mode

Entering a carriage return at the command screen will cause the program to enter the text screen mode and display the first page (screen) of your file. In this mode, you can enter text for a new file, or edit the material you have previously entered. To create a new text file you merely type in the desired material. You do not need to worry about line lengths or inputting carriage returns at the end of each line. When you reach the end of a line, the display will automatically go to the next line. If a word does not fit on the line, it will automatically be moved to the start of the next line. (The EDIT program also includes a program mode option that defeats this word wrapping feature. This mode is designed for the entry of source code in a programming language such as Basic or assembly language, etc.) The cursor can be moved to any point on the screen, whether or not there is any text there, and is not limited to staying within the current line length you have established.

To edit an existing file, you move the cursor to the position where you want to change the file. To change a character, you simply type the new character over the old one. You can also insert characters that will move all following text to the right, wrapping it around to the next line if necessary. Pressing any cursor control or function key will exit from the character insert mode. There is also a full insert mode, which allows you to type in new text just as if you were creating a new file. In this mode you can use the cursor control and function keys without leaving the insert mode.

In addition to the single-position cursor controls, (up, down, left, right), the EDIT program allows you to position the cursor at the top or bottom of the text, as well as scroll lines or pages forward or backward. You can delete characters, words, or lines. Line delete requires two strokes of the line delete key to prevent accidental deletion. There are also provisions for manipulations of blocks of text. Blocks can be moved, copied, or deleted. A search feature is included to find a desired word (or words) in the file. Search can be combined with replace, to create a search and replace function for changing one word to another. This function can be repeated without re-entering the target word. It can also be specified to repeat a fixed number of times, or it can be global, which will cause all occurrences of the search word to be changed.

The keystrokes required to accomplish all of these functions are dependent on the type of terminal you are using. If you have a terminal with no special functions keys, various control keys will be used. With an intelligent terminal, such as the Televideo 950, the function keys on the terminal are used so you do not have to press two keys simultaneously. On the Xerox 820 that I use, the numeric keypad is used for the various functions. For most of the functions, it is necessary to hold the control key down when you press the keypad key. This allows the terminal software routine to distinguish between the Magic Wand commands and the normal numeric output of these keys. A minor inconvenience, but it does allow use of the keypad for numeric data entry.

Unlike some other word processing packages, with Magic Wand what you see when using the EDIT program is definitely not what you get. You can enter and edit text using the full screen width of your terminal, and print it using a narrower (or wider) line. The EDIT program does not show page breaks, or special formatting features such as underlining, boldface, or reverse indenting. Whether this is a good or bad feature is the subject of much debate, and is primarily a subjective matter. It doesn't bother me, and I think it makes text entry easier and faster, since the program does not have to manipulate the screen nearly as much to make it look like a printed page. Showing page breaks has some merit, but it is not absolutely necessary. You can't really italicize or type in boldface on a video screen, so why present a faked version of these features?

Printing the text

After editing your file, you will normally write it to the disk and then print it using the PRINT program. It is here that you will discover the real power of the Magic Wand system. You can use print commands, either entered from the keyboard or imbedded in your text file, to control the exact format of your page. To quote from the Magic Wand manual, "Some of the commands control the shape of the text, how it is placed on the page, the margins, spacing, etc. These commands give you complete control of your printer, so that you can make it do things you never thought possible. Other commands determine what is printed. You can access external data files, e.g., name and address lists. You can create fill-in-the-blank files that you fill in automatically as you print. You can create a file with commands that are executed only if certain conditions are met, so that one file can print several different letters." In other words, if there is any way to print the material you have, Magic Wand can probably do it.

The operation of the PRINT program is similar to the EDIT program. After you load the program you can change the disks in the drives, so that the program does not have to take up space on your data disks. You can then start printing immediately, or you can display a command screen that lists the current values of the internal variables used to control the printed output. You can change any of these variables at any time to vary the output format. Commands are available to control the

The Print program contains the real power . . . if there is a way to print your material, Magic Wand can do it.

margins and line spacing. You can indent paragraphs any number of characters, or you can set the left margin in from the edge of the paper and use reverse indenting. Margins can be flush left, flush right, or justified left and right. Justified margins are supported in two different modes. The normal mode expands the spaces between words, in the smallest increment your printer will support, to line up the right margin. The character justification mode adds additional space between all characters to justify the right margin. You can use subscripts and superscripts, print in boldface, underline, or any combination of these features. You can insert headings and footings at the top and bottom of any or all pages. True proportional spacing is supported by Magic Wand, wherin the space occupied by a character is dependent on the width of the character.

Choice of printer

Of course, to use these special features you need a printer which can do these things. Most of the currently available letter quality printers, such as the Diablo, Qume, and NEC Spinwriter, support these features. You can also direct the output to the screen for a quick look at the results (without some of the special features), or you can direct it to a disk file for later spooling while you are editing a different file. The disk file will contain all of the special control characters needed to cause the proper printer action.

You can use commands to force new lines or pages, start and/or stop printing on a specific page, or print multiple copies. There is a conditional new page command that you can set at the start of the printout to prevent the first line (or as many lines as you wish) of a paragraph from starting on the bottom of a page. You can suppress the output of formfeed characters to the printer to print nonstandard page lengths. You can tell the program that you are using single-sheet paper, and it will pause at the end of each page to allow you to insert a new sheet into the printer. All of these features can be controlled from the keyboard during printing, or can be activated via commands embedded in your text file.

To embed commands directly in your text file, you mark the commands with a special command character. The command character is normally a reverse slash (\) but of course there is a command to change the command character to something else so that you can print it. You can embed a command in the middle of a word to create special effects if you want to. For example, you could print a word partially in regular print and partially in bold face, by embedding the appropriate commands within the word.

In addition to the command character, Magic Wand recognizes other special characters. These recognition characters are used to activate the special features. You can insert conditional hyphens in a word, using a special recognition character, and Magic Wand will hyphenate the word at the point if the whole word will not fit on the line. You can mark sections of text to be underlined with a special recognition character. Similarly, you can mark subscripts, superscripts, and sections to be printed in boldface. If you need to send some special control character to your printer, such as the control character to select the alternate character set on a print wheel, there is even an OUT command that allows you to send any value to any output port on your system.

You can print or test internal variables used by the Magic Wand program. Internal variables keep track of the current column number, line number, page number, and the number of lines left on the page. Other internal variables record the number of copies you have printed, and keep track of any external data files you are using. You can use these variables to print page numbers, determine how many lines you have left on a page, skip to a given line, or determine the status of your data file.

You can also define your own variables to control what is printed or how it is printed. You can use up to 128 different variables in processing your text file. You can define string variables, integer numeric variables, or decimal dollar variables. You can print any of these variables in your text, changing them dynamically for multiple printouts of the same file. You can add and subtract numeric variables, and assign the value of one variable to another variable. You can use IF statements to test and compare the length or values of variables in a manner very similar to programming in Basic. The SKIP command allows you to skip over a given number of lines in your text. You can also use the SKIP command to skip to a specific character in your file. By combining IF statements with SKIP statements you can make the variables you have defined control what portion of your text is printed.

The values of the variables may be set directly in your text file or they may be read from the keyboard or a disk file during the printing process. You can issue a prompt to the screen requesting the input of a variable. If you are running multiple copies of the same printout, you can test a variable and request its input only if it has not previously been entered.

Data files can be either text files with variable line lengths, or fixed record length files generated by another program. For example, you can access a fixed record length name and address file and print a mixture of three and four line address labels with Magic Wand. All of this without having to buy any additional support programs.

Documentation

With all of these special features, it may appear that it would be difficult to learn to use Magic

The power and flexibility of output processing are Magic Wand's strongest points.

Magic Wand continued . . .

Wand, but this is really not the case. When you receive your Magic Wand disk, you will find several sample files on the disk. These files are data files for lessons that are contained in the Magic Wand manual. The manual is written in a self-study manner, and leads you through nine lessons in which you manipulate these sample files to learn the various features and capabilities of Magic Wand. The manual includes pictures of actual display screens and print results, so you know what to expect at each step of the lessons.

The lessons start with the basic features you need to know in order to do straightforward editing and printing, and then proceed into the advanced features of special formatting commands and the use of variables. A second section of the manual lists and defines all of the commands and features of both the EDIT and PRINT programs. The manual includes a table of contents and an index so you can reference a particular feature rapidly. If you are working on a file and forget a particular command, just display the command screen and enter a question mark. A brief summary of all of the available commands will be displayed. Entering a command followed by a question mark will provide additional information about that command—not a lengthy description, but usually enough to jog your memory for those commands that you don't use very often.

If you get the impression that I like the Magic Wand word processing system, you are right. The power and flexibility of the output processing are what I consider to be its strongest points. Are there other word-processing systems as good? I don't think so, but I haven't used any of the others enough to become comfortable with them, and besides, I prefer Magic Wand.

Magic Wand was originally developed by a company called Small Business Applications, Inc. That company was dissolved and its assets were acquired by Peachtree Software, Inc. Peachtree released a new version of Magic Wand about a year ago that has since become the standard version. It retains all of the good features, and, in addition, the program is now menu driven so that it is not necessary to return to the CP/M operating system to switch between editing and printing of files. The initial reports on this new version are that it is even better than the old Magic Wand. In one Peachtree advertisement I saw, they stated that they liked it so much that they decided to put their name on it. From now on, Magic Wand will be called the PeachText word processor. I think the name change is a mistake, but of course I may be prejudiced.

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SOFTWARE REVIEW

Spellbinder

A word processor with custom-designable macros

by F. B. McLaughlin

Spellbinder by Lexisoft is a very sophisticated, very powerful word processor and office management system capable of accommodating almost any word processing need. Using a typographic quality printer or letter-quality precision printer, Spellbinder can produce camera-ready copy of such quality that the layman might think it had been typeset.

Not that any full-featured word processor is simple to use, but Lexisoft has made Spellbinder's use quite painless. For instance, Spellbinder uses the function keys and the keypad of my H-19 (Heath/Zenith) terminal, but instead of requiring me to memorize the new functions of these keys, Lexisoft has made a set of replacement keytops available—in red and blue, no less—double-inscribed in most cases with the original and the new functions. This alone takes the curse off learning a new system.

Some features of Spellbinder

Spellbinder provides a host of features, such as:

- Full-screen display
- Full printer support of typographic-quality printers as well as letter-quality precision printers and dot matrix printers
- Help messages customized to your particular needs
- Complete management of oversize files
- Disk directory display
- Word wraparound
- Total cursor control
- Text addition, deletion, change
- Horizontal and vertical scrolling
- User-controlled tab table
- Individual line left margin control
- Full block control
- Automatic search, search and replace, search and delete, search and add, search with wildcards
- Full hyphenation control—hard, soft, firm
- Print-to-screen and print-from-screen capabilities
- Savable format tables
- Proportional spacing with user-definable character width table
- User-definable letter table
- Incrementally variable character spacing
- Centering
- Right justification
- Max and min word space control
- Nestable subscripts and superscripts
- Incrementally variable line spacing
- Bidirectional printing
- Pagination and titling
- Printing enhancements
- Positive and negative line and form feeds
- Ribbon color change and wheel change control
- Pitch-independent formatting
- Comment insertion
- Twelve built-in macros
- Custom macros

And even this is not a complete list of Spellbinder's capabilities. In fact, I have no idea where the list may end, since it would take a long, long time to explore Spellbinder's limits exhaustively.

I had been searching for *the* word processor for some time when the manager of the area Heathkit Electronics Center suggested I try out Spellbinder. I needed a general-purpose word processor to use with my Heath/Zenith H-8 computer (64K memory, Z80 CPU), H-19 terminal, H-17 triple 5¼" floppy disk drives and Diablo 1640 printer. I am the editor of the Denver Heath Users' Group newsletter and need a word processor for writing the newsletter, an occasional magazine article, lots of correspondence, and for editing downloaded text from the Denver Heath Users' Group Bulletin Board System and from the information nets. Consequently I was looking for a first-rate word processor. Spellbinder can handle all my needs with minimum effort on my part, and best of all, give me complete control over the Diablo.

System requirements and installation

In the beginning, Spellbinder has to know all about your system, which is described to it by a configuration program. Lexisoft markets a number of versions for major systems such as Heath/Zenith, Apple, North Star, Radio Shack, Cromemco and the like. They are designed to work with either the CP/M or OASIS operating systems. The hardware queries in the configuration program are those concerning the possible variations of your particular system, such as printer type and availability of function keys and keypad. The rest of the questions have to do with such matters as whether or not you wish the user guides or row and column numbers displayed.

You may permanently configure your program at any time and the questions will no longer be asked. Lexisoft suggests the newcomer wait until he has become a little more familiar with Spellbinder. After all, there are tables to be configured to your taste—two format tables, a pagination table, a tab table and a character width table for propor-

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tional spacing control. If you are eager and save the customization after the first time through the configuration program, do not worry—you may change it at will.

Screen capability

Spellbinder has a wraparound feature. You need not use carriage returns except at the end of a paragraph or to create blank lines. Spellbinder automatically shifts to the beginning of the next line when the text reaches the end of the line. A partially completed word at the end of the line is shifted to the beginning of the next line.

Text can be displayed and printed at line lengths selectable from 24 characters to 159 (twice the screen width −1), defaulting to the configured screen width. If the selected screen width exceeds your terminal's capability, text is automatically scrolled horizontally at the expense of the text on the left end of the line so you can see all the text you have typed. When Spellbinder reaches the end of the extended line, either a carriage return or the normal wraparound operation returns the cursor to column 1 of the next line. The right and left arrow keys control the cursor over the entire length of the extended line.

Basic operations

Spellbinder has two modes of operation—EDIT mode and COMMAND mode. In general, EDIT mode is used for entering and editing text. COMMAND mode is used for major text changes, I/O operations, and printing.

In EDIT mode, text may be changed by typing over the existing text or by deleting the existing text and inserting new text. Text deletion can be by character, word, sentence, paragraph or block, all single-key commands. The cursor can be controlled in several ways. On the keypad of the H-19, arrow keys control up, down, right, left movement. Combined with the REPEAT key, the cursor will march in that direction one step at a time. A CURSOR SCAN key moves the cursor to the right margin. Tapping CURSOR SCAN again moves the cursor to the left margin. MODE FWARD and MODE BKWARD keys move the cursor forward or backward according to cursor mode, that is, by character, word, sentence, paragraph or block. Function keys permit scrolling up or down a screenful at a time.

In COMMAND mode, text deletion of larger proportions can be accomplished. You may delete by line, by all text following the cursor, or by all text. These are regular keyboard commands rather than special-function key commands. Major cursor excursions can be made from COMMAND mode. The cursor can be moved forward or backward to the next mark or to the beginning or end of text; forward or backward **n** lines at a time.

Tabs can be set anywhere up to column 159 or removed selectively. All the tab stops can be cleared with one keystroke, and regular tab stops up to 10 spaces can be entered with a single keystroke followed by a number representing the number of spaces desired. A default tab table can be configured to your liking and changed at will.

An INDENT feature effectively moves the left margin one tab stop at a time. INDENT is probably most useful in formatting outlines, but I find that I use it a great deal in formatting text inserts. INDENTs may be executed before or after text has been typed. An INDENT remains in force until changed or removed by command or until a carriage return is executed.

The MARK key is used to mark a specific location in text with a nonprinting mark character specifying the point in the text to which you wish the cursor to move on a forward or back command, or to mark the end of the text you wish to delete or remove and place in a holding buffer.

A block of text—anything from a single character to the entire text—may be deleted from the text, moved from one place to another, or copied as many times as desired into as many locations as desired (to the limit of computer's memory). The constraint is one block of text at a time in the holding buffer.

Spellbinder provides a comprehensive search capability. With appropriate commands, you may elect a simple search to find a location in text; a discretionary search and replace; an automatic search and replace, search and remove, search and insert, or search with wildcards. Oversize text may be searched globally with a global search-and-replace command.

Help displays

User guides may be displayed continuously on the bottom lines of the screen, removable at will. Edit mode guides are displayed when in edit mode, and command mode guides when in command mode. A more comprehensive set of guides, by subject, may be called up as needed. The subject may require an entire screen or even several screens of explanation. Since these subject guides are programs, you may write your own. You may even call up and examine other documents and programs without losing your place in the text being edited.

If you find you have repetitive tasks that would require the same operator interface again and again, such as printing a file multiple times, an auto-command may be issued that will direct the entire operation without the need of further operator interaction.

There are a number of miscellaneous commands available for such diverse needs as calling up the disk directories without disturbing the text in memory or the cursor location, displaying the amount of unused memory remaining, or exiting Spellbinder. The directory listing is particularly helpful when you are concatenating files or inserting a file into text.

You cannot upload Spellbinder text, as stored, to a network—you must make a print-image file first.

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I/O operations

Spellbinder will manage files of any size up to the disk operating system's limits. You may direct the details of opening the file, reading the text into memory, writing the text to the file and closing the file, or you may leave the details to Spellbinder. If the file is oversize, that is, larger than the computer can accommodate in one operation, Spellbinder will read into memory only as much as will fit. When you have finished editing that portion of the file, a single keystroke will direct Spellbinder to write that portion of the file to an output file and read in the next portion of the input file. In this manner a file as large as 500,000 characters may be edited. Edited files may be concatenated into a single output file to the limits of the disk operating system. A file or any portion thereof may be inserted at any place in the text in memory. Files may be deleted from a disk at any time.

Since a Spellbinder text file is stored as a continuous ribbon of text without line-end carriage returns and line feeds, the text as stored is not suitable for uploading to an information net. Spellbinder has switches available for incorporating line feeds and carriage returns and for converting groups of spaces into tabs when the file is written to disk.

Lexisoft has gone a long way toward foolproofing Spellbinder. Should you elect to control file openings and closings yourself, Spellbinder will not let you exit the program with an open file. Should you command the abandonment of a text file in memory, Spellbinder will require reassurance that you really mean it before complying. A means is provided for making sure that the file name of the file you read from disk is the same as the file name you write back to disk when you have finished editing. Backup files are provided automatically, though on the same disk.

Print formatting

Printing options are contained in a format table of 16 values. The table may be displayed at any time and changed at any time. If you wish, a two-key command will display the format table as a nonprinting line of text, which ensures that the options selected for the text will prevail no matter where the table happens to be set at the time the text is printed. A second format table, also displayable, is available by a two-key switch. You may switch formats as often as you like, which is a very useful feature when you want to change format for a text insert, for instance. Options include:

- printer type (precision, dot matrix, CP/M list device)
- destination (I/O device)
- print routine (line or character oriented)
- print length (length of text page in 10ths of an inch)
- form length (in 10ths of an inch)
- page eject
- left indent (in 10ths of an inch)
- line spacing
- justification (right, left, right and left, center)
- line width (in 10ths of an inch)
- line feed size (in 48ths of an inch)
- character size (in 120ths of an inch)
- special character
- proportional spacing
- maximum space
- minimum space

Some of these options are available only to precision printers, that is, printers which are capable of line feed control to 1/48th of an inch and character spacing to 1/120th of an inch.

A separate table controls titling and pagination. If desired, top or bottom titling is available and top or bottom pagination at right, center, or left. You may elect separate title/page number locations for odd- and even-numbered pages, and you may select the starting number. The table may be called up at will and changed at will, or written into text.

If you have specified a precision printer, Spellbinder prints bidirectionally unless otherwise commanded. For nonroutine applications, other commands specify unidirectional, space-filled lines.

As desired, printing can be (1) even left margin, uneven right margin; (2) even right and left margins; (3) uneven left margin, even right margin; (4) centered on the line. If you have specified a precision printer and you select even left and right margins, the extra space, if there is any, is evenly divided among all the spaces on the line, giving the appearance of printing. Otherwise, the extra spaces are randomly added to the normal spaces between words.

The width of the text line and the length of the text page are specified in tenths of an inch. This saves you from having to calculate the actual number of characters per line in character mode or lines per page.

Vertical pitch can be set to 3, 4, 6, or 8 lines per inch or, for precision printers, set to whatever line space you wish in increments of 1/48th inch. Correspondingly, horizontal pitch can be set to 8, 10, 12, 15, user-defined pitch, or, for a precision printer, set to your choice of character spacing in increments of 1/120th inch. Both horizontal and vertical pitch commands can appear anywhere in the text, and the horizontal pitch may be changed for as little as one word.

Spellbinder offers an inclusive set of character enhancements. For precision printers, there is shadow printing. For any printer the available options are underline, slash or dash overstrike, boldface, space (instead of character), skip character (null) or ignore enhancement. You may underline just the words in a phrase or both the words and the intervening spaces. Enhancement can be

Spellbinder allows for user reconfiguration of the system at any time.

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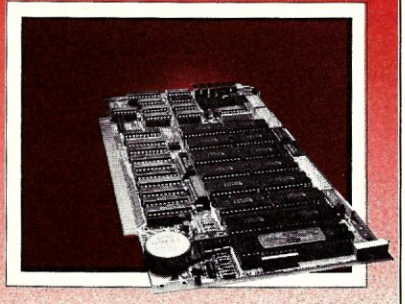

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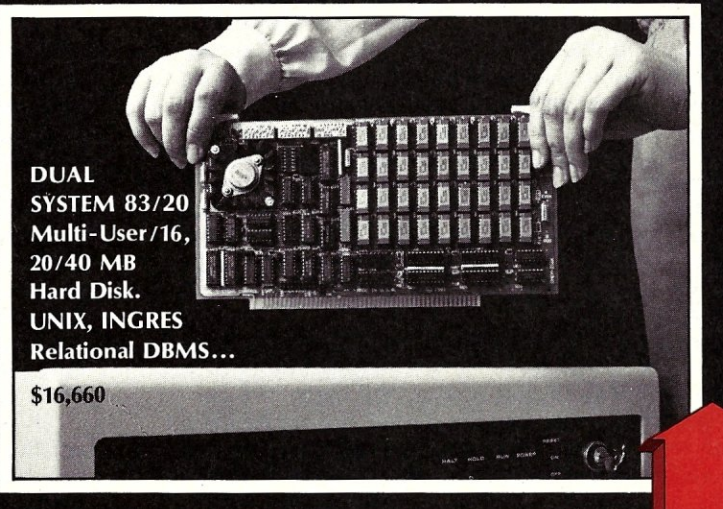

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CIRCLE 151 ON READER SERVICE CARD

changed at any place in the text.

For precision printers, proportional spacing is available. Included in the set of Spellbinder programs is a proportional space table that you may change temporarily or permanently to suit your own tastes or a different precision print wheel or thimble. You may develop multiple space tables.

The maximum and minimum space options in the print formatting tables are for use with right-justified printing, where sometimes the space between words becomes unacceptably large. You set the maximum and minimum space in increments of 1/10 space. Spellbinder will not exceed these limits, but rather will stop printing, display the first word of the next line, and give you the opportunity of either hyphenating that word or accepting the excessive spacing.

Some print-formatting commands are dot commands. For example, a ".c" at the beginning of a line of text centers that line; a ".e" ejects the current page from the printer. Other dot commands define titles, cause form feeds, command vertical tabs and negative line feeds; define nonprinting remarks, and command printing termination. Other formatting commands may be embedded dynamically anywhere in the text. They include superscripts, subscripts, hyphenation, character enhancement, absolute tabs, font switches, pauses, line feeds, back spaces, and others that provide changes to the formatting table. You even have six user-definable functions available. While these commands are uncommon characters, or common characters used in an uncommon way and appropriated for command purposes, they may still be used normally by enhancing the character and then defeating the enhancement.

Printing

Spellbinder has two printing modes—line-oriented and character-oriented. In line-oriented format the printed page looks just like the screen display. In character-oriented mode, the line length depends on the value in the print formatting table.

Three kinds of hyphenation are available. There is the hard hyphen, as in "attorney-at-law." This hyphen will be printed regardless of where it appears on the line. A soft hyphen may be used in the line-oriented mode to break apart an overly long word at the end of a screen line. The soft hyphen will be printed. In character-oriented mode, the over-long word may or may not come at the end of the printed line. If it does, the hyphen is printed. If it does not, the hyphen is not printed and the word is closed up. In either mode, if you edit the line and the hyphenated word is moved from the end of the line, the hyphen disappears. If you then re-edit the line and the hyphenated word is again at the end of the line, the hyphen will not reappear.

The third, or firm hyphen, responds just as does the soft hyphen, with one exception: If editing moves the hyphenated word from the end of the line, the hyphen does not disappear—but it will be printed only if the hyphenated word comes at the end of the line.

A very useful feature of Spellbinder is the ability to verify what the printed page will look like without actually printing the text. A one-key command will display the text on the screen as it will look printed on paper, with obvious limitations. The screen cannot display proportional spacing, right justification, subscripts, or superscripts. Other than that, printing errors will be pointed out and can be corrected before the actual printing is done. Display will stop at the end of every page to let you look at the page ending. The display occurs at the terminal's display rate, which is inconveniently fast, but the display can be turned on and off and so controlled in this manner. Another one-key command will verify printing and stop at the end of each page, but will not display text.

Oversize files can be verified or printed. Global verification includes automatic writing to an output file, so the corrections you make to the file being verified are automatically reflected in the new output file. If you choose, global printing can also include writing the file being printed (and edited) to an output file so you will have an exact copy of what was printed.

Spellbinder can be commanded to print a page, a file resident in memory, an oversize file on disk, or any specific number of lines of text. Spellbinder will print multiple copies of a document without interruption or further direction. Spellbinder will even batch-print multiple files.

Macros

A macro is a series of commands that will be performed sequentially and automatically. Twelve macros are included with Spellbinder, and you may write your own custom macros. Those included are:

- *LINENB*—numbers each line of both the printed text and the displayed text for editing purposes;
- *FORMS*—provides forms fill-in and forms generation capability, with mathematics and access to a data file;
- *BOILER*—enables you to create boilerplate paragraphs and call them up into a file by number;
- *BATCH*—automatically prints multiple files;
- *2CPRINT*—prints text in two columns for camera-ready copy;
- *CUESORT*—sorts a file on up to 20 classifications and as many categories as will fit on one screen line;
- *MMERGE*—prints a form letter to each person on an associated mail list;
- *ALPHA*—a general-purpose sorting macro; also capable of sorting by zip code.

Twelve macros are included with Spellbinder, and you may write your own custom macros.

Introducing...

ELECTRALOGICS' MFIO

The most versatile and capable I/O board available for the S-100 bus.

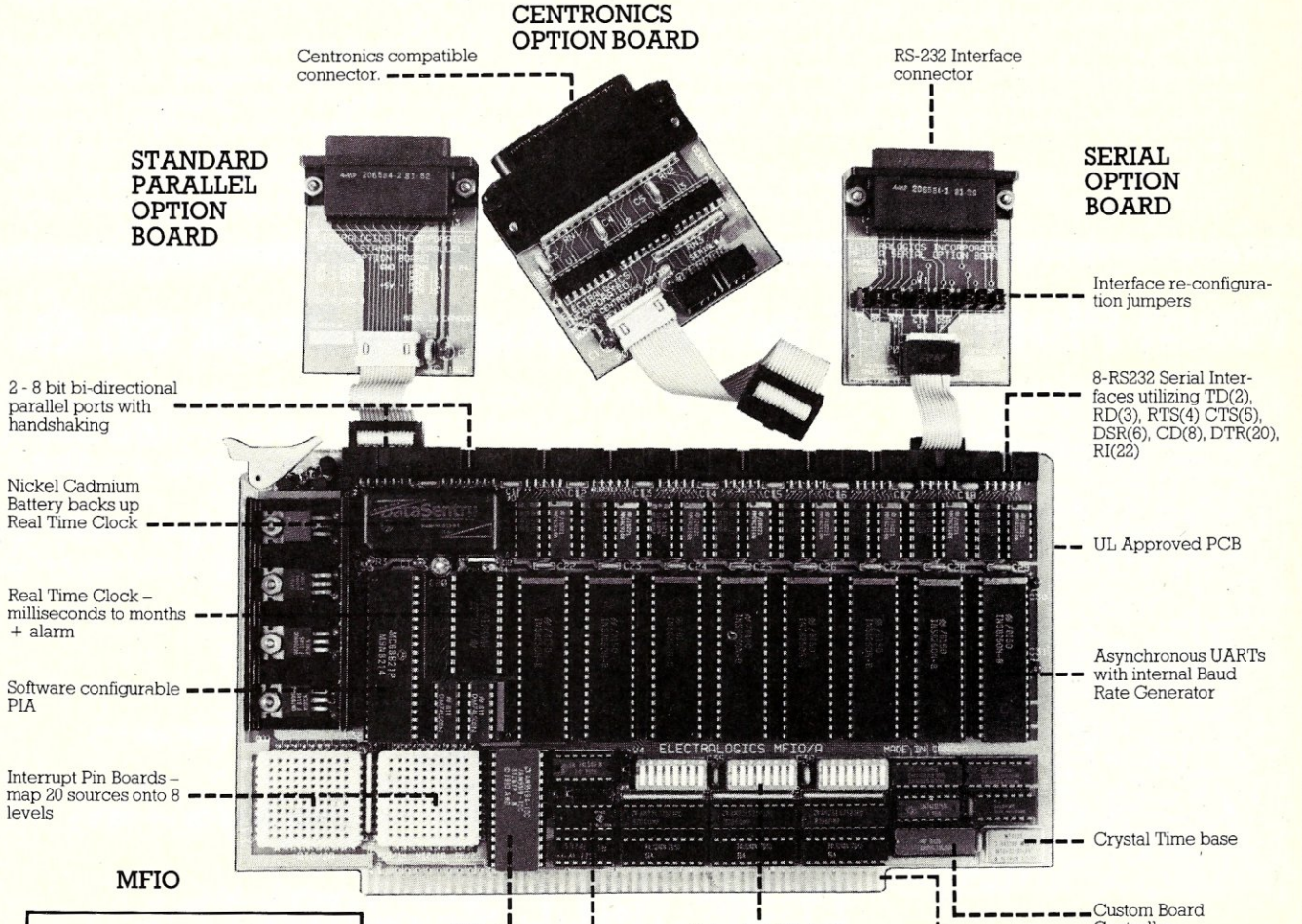
Electralogic's MFIO is the most versatile and capable I/O board available for the S-100 bus. The 8 asynchronous serial ports, 2-8 bit bidirectional parallel ports, 8 level programmable interrupt controller and battery backed-up real time clock provide all the features which traditionally required 3 or more boards.

The design meets the needs of OEM's and system integrators who demand high density and reliability in their products.

Additional capabilities include: extended I/O addressing, up to 6 wait states, jumper selectable for high speed systems, easy to use interface cards and serial data rates up to 57.6 K baud.

The 2 pin boards allow any of 20 interrupt sources (11 on board + 9 from S100 bus) to activate 1-8 interrupt levels. The board comes complete with extensive manual and source listings for standard CPM* BIOS, interrupt driven BIOS, clock set routine, time print routine, diagnostic routines and sample device initialization routines.

*CPM is a trademark of DIGITAL RESEARCH



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ADDIT—adds columns and rows of numbers and locates the answer in the text;
KPHRASE—allows any key to be predefined as a word, expression, or sentence when preceded by a specific key;
CALC—exits to a calculator mode, operating with both standard registers and with information in text;
MOVEIT—allows the editing of columns of data including deletions, insertion of text, insertion of columns from other documents, and moves within a document.

Performance assessment

If you now believe that Spellbinder is indeed a most powerful word processor, I have succeeded in my intent. Moreover, with the recent advent of a new version, 5.1x, some previously existing bugs have been eliminated and a number of new features and improvements to existing features have been incorporated. Unfortunately, some new bugs have appeared in the new version. Only a couple of them are significant, though. When, in the right-justified printing mode, you're using the command that causes the printer to overstrike one character with a second, the column counter counts the second character—hence the last column of the line is a blank.

The other significant shortcoming of Spellbinder is not really a bug—it is more a matter of judgment. Spellbinder optionally carries on the message line (the top line of the display) a running count of line number and column number. The line number counter counts command lines as well as text lines, which destroys its usefulness for detecting the approaching end of a page. If you are incorporating footnotes at page end, it would help to know during text writing exactly where the page ends. Lexisoft's decision to ignore this problem is, in my opinion, poor judgment, since footnotes cannot easily be incorporated into the text.

One remaining annoyance is not really Spellbinder's fault. The problem lies with CP/M, the operating system. CP/M 2.2 has no type-ahead buffer, as does HDOS (Heath/Zenith's operating system), so if you type too fast, as, for example, when ending a paragraph with a carriage return and typing a second carriage return to create a blank line between paragraphs, the computer may not see the second carriage return and consequently no blank line is printed. You have to learn a deliberate rhythm to such operations to avoid this problem. Brought up on HDOS, I find this trait most annoying.

Spellbinder's greatest weakness is its instruction manual. It is only average at best, and not nearly up to the quality of the program. The manual appears to have been edited critically for spelling, grammar, and syntax, but not for usability. While sections were rewritten and improved in the new release, it is still frequently ambiguous, par-

Spellbinder continued . . .

ticularly in the more complex explanations. On the plus side, the manual includes a detachable, bound tutorial section for leading the newcomer through the introduction to the system, which it does very well. It also contains a quick-reference section that is useful, particularly for the experienced operator. However, it has no index or glossary, so it is not always easy to find a particular reference.

All in all, Spellbinder is a very good and very sophisticated word processor. Deplorably, Lexisoft has not proved to be very good to do business with. They exhibit a churlish attitude toward their customers in that they do not answer letters—at least they have not answered mine or my vendor's. Consequently, I have been unable to get any help with the problems I have found with Spellbinder. When you have invested as much as $495 in a word processor, you have the right, I believe, to expect a helpful attitude on the part of the manufacturer toward your problems in using his product.

I can recommend Spellbinder to those who need its more advanced features, provided they can cope with the ambiguities of its manual. I cannot recommend it to the newcomer to word processing because of the manual's shortcomings and the company's apparent attitude toward its customers.

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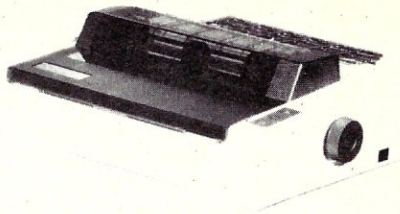

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S-100 Memory Boards

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CIRCLE 16 ON READER SERVICE CARD

Modifying WordStar for an Epson Printer

How to obtain full use of all the Epson's facilities

by Ernest E. Mau

WordStar's best features normally are obtained only with printers such as the Diablo and Qume daisywheels and the NEC Spinwriters, which have special capabilities allowing horizontal and vertical motion in small increments. Using those printer capabilities, WordStar achieves many attractive effects in its printouts, including boldfaced type, double-struck type (a lighter boldface), underlining, above-line superscripts, and below-line subscripts. All these special features and others combine to allow the preparation of documents with a truly professional appearance.

Yet many people can't justify the added expense of a letter-quality printer and instead choose the less costly dot-matrix printers such as the Epson MX-80 or MX-100. For the price, those are excellent printers and have many unique features of their own such as an expanded type font, a compressed type font, superscript and subscript fonts, an italic type font, and various combinations of those with or without underlining, boldfacing, and double-striking. The problem is that many of the Epson features at first seem to be inaccessible from WordStar. However, I'm going to show that most of the printer's functions are indeed usable with WordStar, and with little difficulty.

The INSTALL.COM program allows you to reinstall WordStar any time you choose, altering the operating parameters to accommodate your changing needs. To show how WordStar can be reinstalled to make maximum use of an Epson printer, I'm going to assume that you already have a working version of WordStar saved on your disk under the name WS.COM. Note that this is not the raw, uninstalled program named WSU.COM that either you or your dealer have had to install to obtain the working program for your system.

Beginning the reinstallation

Format and prepare a new copy of the program disk using your normal CP/M utilities and copying procedures. Be sure that the new copy has the CP/M operating system, the WS.COM file you are going to reinstall, the INSTALL.COM program, and the necessary WordStar overlay files. Once you have such a disk inserted into Drive A and are sure that it is not write protected, type a CTRL-C (Control and C keys simultaneously) to log the disk and allow data to be written to it.

Run the installation program by typing INSTALL followed by a RETURN. The program will load, run, and begin asking you various questions. Since you are reinstalling an existing and working WordStar program named WS.COM, answer the first question about a normal first-time installation with an "N" to display your other options. From those options select either B or C to reinstall an WordStar COM file of your choice and save it under a new file name of your choice. When asked the name of the file to be installed, answer with WS to indicate your existing and preconfigured version. When asked for the name of the file under which to save the new program, answer with a different name—I suggest something like WSMOD.

The next series of questions asked by program all have to do with the terminal and printer setups. Since you should be reinstalling a working program already matched to your system, you would choose setup "U" (for no change) in each case and leave the basic terminal, printer, I/O port, and protocol configurations unchanged. You'll also have to verify each step with a keyboard "Y" to proceed to the next. If you're running a parallel Epson printer, you should notice that it is installed as a "teletype printer that can backspace," is probably run as a "LST:" device, and requires no protocol. If, however, you are set up as "any teletype-like printer," you probably should go ahead and change that one parameter to "any teletype-like printer that can backspace."

Finally, you get to the question "*Are the modifications to wordstar now complete?*" This where most users and dealerships stop the installation by answering "Y", but it's also where the fun begins. To install the special Epson modifications, you must answer "N" to this question, thereby entering WordStar's "patcher" routine.

Using the patcher

The patcher is provided so you can change individual values within the terminal and printer control sections of WordStar itself. For this session, you'll be working within the "printer patch area" that is documented in an appendix to your manual as the "USER4 Listing."

You must modify some unused segments of the printer patch area to build in new controls and operations not normally provided when a teletype-like printer is specified in an earlier step. These patch areas are preconfigured when a letter-quality printer is installed, but normally are "zeroed out" for Epson and other dot-matrix printers.

Each patch area of concern has a name or mnemonic that defines it. A typical example would be PSINIT: which names the string used to initialize the printer at the start of a printout. Note that the colon is part of the name and must be entered

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when accessing a patch area. In all but a few cases, each patch consists of one byte that specifies the total number of associated bytes to follow, and then the actual bytes to be transmitted by WordStar to the printer. All values are entered as hexadecimal numbers—if you try to use decimal numbers or ASCII codes, you will not achieve a workable program patch.

Once you've entered the patching routine, you call a patch location by specifying its mnemonic (with the colon). The screen then displays a line indicating the memory location and current value stored in that location, and it provides you with a place to enter a new value. To keep the existing value, simply strike the RETURN key. To change value, simply enter the new hexadecimal number and a RETURN. When again asked for a location to modify, either enter a new mnemonic or hit RETURN to simply progress to the memory location following the one just changed. To terminate all changes and exit the patcher, type a zero (0) and a RETURN.

Setting up double-width type

The first patch is one to use the Epson double-width type font. From the Epson manual, there are three ways to activate this feature, one lasting only to the end of the line and the others lasting until turned off. The one needed is an "ESC W n" sequence, where the value of **n** indicates whether double width is turned on or off. An ideal place to install this is in the unused WordStar patch areas designated for ribbon color toggling. The patches needed are:

RIBBON:	Ø3H	RIBOFF:	Ø3H
RIBBON:+1	1BH (ESC)	RIBOFF:+1	1BH (ESC)
RIBBON:+2	57H (W)	RIBOFF:+2	57H (W)
RIBBON:+3	Ø1H (on)	RIBOFF:+3	ØØH (off)

Notice that I've entered a hexadecimal 57 for the letter W rather than the 61 indicated in Appendix B of the Epson manual. This is one of several items in that appendix for which Epson has listed an erroneous hexadecimal code (hex 61 is a lowercase "a").

With this patch, you'll be able to turn on double-width by embedding a CTRL-Y command in your text to start double width and another CTRL-Y to switch it off again (just like the CTRL-B for boldface and the CTRL-D for double striking). You need to be a little cautious, however, since this font is only five characters per inch instead of the normal ten. You'll have to play around with margin setting and space counting to get your copy to look right. I usually reserve this just for headers, and I then set the WordStar ruler to half its normal length for the lines affected, enter my text, center it if necessary, and then reset the ruler back to normal before continuing.

Also remember that Epson double-width type doubles the number of lines used, so it's necessary to account for a displacement of the page-break indications while editing. I typically get around the problem by forcing conditional or unconditional page breaks throughout my documents, and simply remember to force a break earlier when I've inserted any double-width lines.

Setting up compressed type

Installing the patch for Epson compressed type is best accomplished using the alternate type font available from within WordStar. This provides regular 10 cpi type as the "normal" size and 17.6 cpi as the "alternate." Within the Epson, an ASCII SI (Shift In) turns on the compression, and an ASCII DC2 (Device Control 2) turns it off, so the patches needed are:

PALT:	Ø1H	PSTD:	Ø1H
PALT:+1	ØFH (SI)	PSTD:+1	12H (DC2)

With this patch made, you can switch to compressed type by embedding a CTRL-A in your text, and then return to normal type by embedding a CTRL-N. Again, you have to watch your line spacing and make some margin adjustments when editing lines to be printed in this size. If the entire line is to be compressed, the easiest method is to temporarily set the ruler line to its original length plus an additional 75% of its length. That is, a ruler normally set at 65 characters would be reset to 114 characters (65 plus 49). If only a portion of a line is to be compressed, you'll have to do some character counting and combine or force new lines when and where necessary.

With compressed type you don't, however, have to keep track of lines on the page as you do with the double-width type. Compression doesn't change the line height or the number lines on a printed page, so the page breaks indicated by WordStar should be valid in nearly every case.

Setting up italic type

Setting up the Epson italic type font is a little more complicated. It happens that WordStar provides four "user functions" that can be specially defined for a printer, and at first glance it appears reasonable to use one to switch italics on and another to switch them off. However, we haven't yet accounted for subscripts and superscripts; these require three codes for superscript on, subscript off, and either superscript or subscript off. Therefore, at least five patches are needed, and there are only four user patch areas. The easiest way around the dilemma is to use one user patch area to activate italics, use something else to deactivate italics, and use the remaining three user patch areas to activate and deactivate scripting.

Since scripting will be accomplished by user codes rather than the normal WordStar CTRL-T and CTRL-V commands, the "rollup" and "rolldown" patches used in scripting become available for use. Therefore, I like the arrangement where user function 1 (CTRL-Q) switches into italics and either a CTRL-T or CTRL-V switches back

Many of the Epson features at first seem inaccessible from WordStar . . . yet most of the printer's functions can be made usable with very little difficulty.

to normal. The Epson codes for italics are an "ESC 4" to switch on and an "ESC 5" to switch off, so the WordStar patches are:

USR1:	Ø2H	ROLUP:	Ø2H
USR1:+1	1BH (ESC)	ROLUP:+1	1BH (ESC)
USR1:+2	34H (4)	ROLUP:+2	35H (5)
		ROLDOW:	Ø2H
		ROLDOW:+1	1BH (ESC)
		ROLDOW:+2	35H (5)

This is getting pretty sneaky, isn't it? So far, we've conned WordStar into allowing Epson double-width, compressed, and italic type fonts. And we're not done yet.

Setting up scripting

As I've mentioned, you can't use paper motion to achieve subscripting and superscripting with the Epson printer—the printer isn't capable of doing negative line feeds or negative partial line feeds that normally are used for these functions with letter-quality printers. Instead, it's necessary to activate and deactivate special Epson type fonts with the remaining three user functions that haven't yet been defined. The ASCII codes needed by the Epson are "ESC S n" to switch one or the other on (**n** is zero for a superscript and **n** is nonzero for a subscript) and "ESC H" to switch off again. The patches to install these codes are:

USR2:	Ø3H	USR4:	Ø2H
USR2:+1	1BH (ESC)	USR4:+1	1BH (ESC)
USR2:+2	53H (S)	USR4:+2	48H (H)
USR2:+3	Ø1H		
USR3:	Ø3H		
USR3:+1	1BH (ESC)		
USR3:+2	53H (S)		
USR3:+3	ØØH		

Now, you activate a superscript by embedding a CTRL-E, activate a subscript by embedding a CTRL-W, and turn either off by embedding a CTRL-R when the script is completed. Note, however, that the CTRL-R also turns off any double-width type in effect at the time, so you will have to remember to reset the double-width mode if you need it after any superscript or subscript.

Unless you have either double-width or compressed type in effect when you do scripting, the line length should remain unchanged. The Epson script fonts are smaller than normal vertically but require the same horizontal space as the normal font characters, so no margin adjustments are needed unless you also activate other commands for something like a compressed superscript.

Altering printer initialization

It's advisable to alter the initialization and deinitialization strings sent to the printer by WordStar when starting or ending a printout. Proper alteration assures that you won't be caught off guard by some parameter set during a previous printout and remaining in effect when you start another. As you start the print run, reset the Epson to its power-on state (all parameters set for normal type)—set it so it doesn't attempt to skip over perforations, and force the printhead to the left edge of the paper. These are accomplished by an "ESC @" to reset parameters, an "ESC O" to not skip over the perforations, and a "CR" to return the printhead.

When ending the printout, it does no harm to reset the printer to power-up status with an "ESC @" and force the printhead to the left margin with a "CR." In fact, if you're doing "cut sheet" letters, it's an advantage to have the head at the left margin when inserting sheets to facilitate loading and aligning the paper. The necessary patches are:

PSINIT:	Ø5H	PSFINI:	Ø3H
PSINIT:+1	1BH (ESC)	PSFINI:+1	1BH (ESC)
PSINIT:+2	4ØH (@)	PSFINI:+2	4ØH (@)
PSINIT:+3	1BH (ESC)	PSFINI:+3	ØDH (CR)
PSINIT:+4	4FH (O)		
PSINIT:+5	ØDH (CR)		

You might be tempted to add either the Epson double-strike ("ESC G") or emphasized mode ("ESC E") features to the standard printer initialization string. It might seem logical to do so, but I must caution you against it. First, the emphasized mode cannot be mixed with subscripts, superscripts, or compressed type, and the resulting control of the printer from within WordStar would become confusing. Second, there is an interaction between certain functions, and attempting to use the Epson's native double striking or emphasized modes can easily result in extra line feeds when attempting to boldface, underline, or perform other functions. A typical problem when doing this unrecommended mix of features is that the line of type goes downhill as it crosses the page.

Miscellaneous patches

The final changes are matters of personal preference and aren't required to use the special printer functions. It happens that I prefer "strikeouts" in text to be done with slashes rather than the normal hyphens and that I sometimes like to have my boldfacing done with a triple hit on the character rather than just two hits. In the latter case, however, some compromise is necessary because increasing the number of strikes also increases the time required to print the affected material.

SOCHR:	2FH (/)
BLDSTR:	Ø3H
DBLSTR:	Ø2H

Summary of new commands

Having performed the preceding patches and saved the altered WordStar .COM file on disk, you will have to recognize some changes to the

Other printers can also be enhanced—just locate an unused patch area and change its function.

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commands defined in MicroPro's instruction manuals. Three of the functions remain unchanged in their use or their effect:

```
CTRL-P CTRL-B -- Retains old function for boldfacing.
CTRL-P CTRL-D -- Retains old function for double striking.
CTRL-P CTRL-S -- Retains old function for underscoring.
```

The new or redefined printing commands resulting from the patches are:

```
CTRL-P CTRL-A -- Set alternate type size (compressed) at 17.6 cpi.
CTRL-P CTRL-N -- Set standard type size (normal) at 10 cpi.
CTRL-P CTRL-Y -- Toggles double-width type (5 cpi) on and off.
CTRL-P CTRL-Q -- Turns on italic type face.
CTRL-P CTRL-T -- Turns off italic type face (same as CTRL-P CTRL-V).
CTRL-P CTRL-V -- Turns off italic type face (same as CTRL-P CTRL-T).
CTRL-P CTRL-E -- Turns on superscript type face.
CTRL-P CTRL-W -- Turns on subscript type face.
CTRL-P CTRL-R -- Turns off either or both superscripting and subscripting,
                 as well as double-width.
```

Of course, various codes can be mixed and matched. For example, by embedding multiple print commands, you can obtain bold and double strike, compressed bold, compressed double strike, bold double-width, double-strike double-width, bold double-width compressed, italic bold, double-width italic, and so on. The list goes on and on, limited only by your imagination.

Other printers

Much the same approach can be taken with other printers when their full capabilities are not normally recognized by WordStar. All that's necessary is to locate an otherwise unused patch area, or one you normally don't use, and change its function to one you need or would like to have. You must, however, test your installation thoroughly since there may be odd interactions between various functions on certain printers. I've been trying for some time to come up with a good set of patches for an Okidata Microline-84, but so far I've only been able to activate a few of its special functions. Whenever I try to activate the alternate type sizes from within WordStar, I run headlong into problems that prevent activation of one feature or another. I've no doubt it can be done, it's just that I've not yet found the right sequence of commands and patches necessary.

In any event, I've shown that you can get a lot more from your printer under WordStar than you might have thought possible. The rest is up to you, and may you forever have attractive printouts.

For information on WordStar, contact:

MicroPro International Corp.
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Note: *WordStar is a registered trademark of MicroPro International Corp.*

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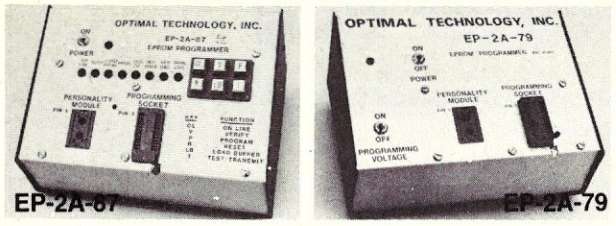

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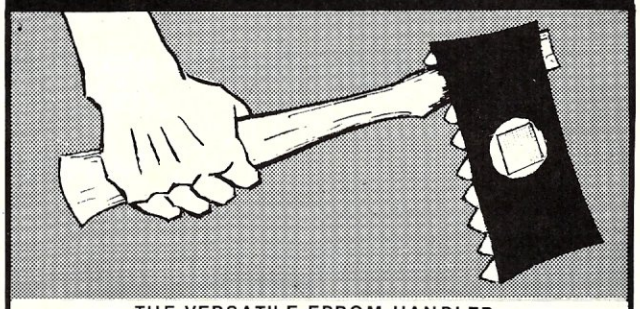

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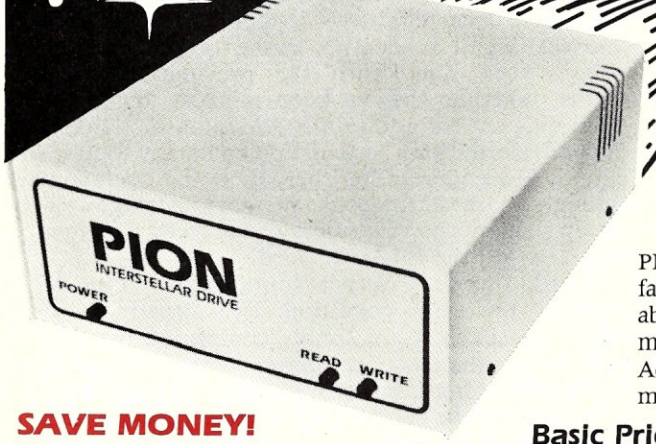

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Swatting a SpellStar Bug

A procedure to avoid the "memory shortage" error condition

by Ernest E. Mau

Individuals using MicroPro International's SpellStar option with WordStar version 3.0 sooner or later are likely to run into a nasty little bug that seems to result from some interactions between the two programs. All seems normal throughout the creation and initial editing of a document under WordStar, proofreading it with SpellStar, and starting the error correction pass when returned to the WordStar editing mode. Then, without warning, up pops an "Internal Error I18: Memory Shortage" message on the screen, and the keyboard locks up.

The first time I saw that, my hand went straight to the "panic button"—an internal error from within a commercial piece of software isn't something the user normally can fix without the aid of the original supplier.

In my own case, it occurred a few words into the final edit of the first document I tried to proofread after receiving SpellStar. The system in use was a 64K S-100 computer with the CP/M operating system configured for maximum available memory. I knew I didn't have a true "memory shortage," simply because there was no way to increase the memory and because the software packages are supposed to run on 48K systems without any problems.

Hit ESCAPE to duck from under

Some lengthy phone conversations with several people at MicroPro turned up some interesting answers about the internal error. First, other users already had reported seeing the problem, so MicroPro was aware of it. Second, nobody seemed to know what to do about fixing the program, so there was no point in returning the software for replacement because a new copy would be no different from the old. Third, users had stated that it was a "harmless" error that appeared to do no damage to the final editing of the document. The recommended procedure, therefore, was to press the ESCAPE key as directed by a screen prompt and simply continue with the editing as though the error never had occurred.

Usually, I found that the "fix" did indeed seem to work. With a few exceptions, pressing ESCAPE seemed to allow the continued editing and correcting of a document without further incident. But in a few cases, somewhere later in the document, the system would "hang," accepting no more keyboard inputs of any kind and requiring a complete restart or cold boot of the system. I don't know how you feel about it, but I don't like to cold boot a system when there is a possibility of a disk file being "open" for write operations. Most of the time it's easy to erase the partial file and start over, but I have had occasions where the reboot with an open file has caused serious and unrecoverable damage to the disk or its directory.

A few weeks later, I found that I had to increase the size of the SpellStar dictionary by proofreading and adding from my own lists of more than 20,000 words used regularly in my writing. Since the new words were arranged in numerous presorted disk files of 2000 to 3000 words each, it was the perfect opportunity to try to identify a pattern and find a possible solution to the SpellStar/WordStar internal error. Luckily, I did find a regular and repeatable pattern, and I was able to find a procedural modification that avoids the error condition entirely.

The bug likes big meals

The first thing to note is that the error does not appear when proofreading and editing short documents. By "short," I mean documents of fewer than 1500 to 2000 total words. Notice that those are total words, not just the unique words or the words not found in the dictionary. As a result, most letters, brief reports, memos, and similar text only a few pages long rarely, if ever, trigger the memory shortage error. Once documents become longer than 1500 words, the chances of running into the error increase in direct relationship to the number of words. By the time a document reaches 2800 to 3000 total words, the error is unavoidable.

The second notable thing is that when the error is going to occur, it always happens at the fifteenth "misspelling." It doesn't make any difference what's been done with the previous fourteen words, whether they've been ignored, bypassed, fixed, flagged for addition to the main dictionary, flagged for addition to the supplementary dictionary, or any combination thereof. If the document is long enough to trigger the memory shortage condition, it happens regardless of correction actions taken before the fifteenth word.

Third, there's a rather subtle bit of damage done by the error condition. I've already mentioned occasions when simply continuing the edit has "hung" the entire computer system. By itself, that's bad enough, but there's other damage even if the edit can be completed. What happens is that the first fifteen words up to and including the point at which the internal error occurs are lost from the record of what is to be done with them. If you indicated that one was to be bypassed, allowing a return at the end of the first complete pass, the return does not occur. Worse, if you flagged any or all of the first fifteen words for addition to a dic-

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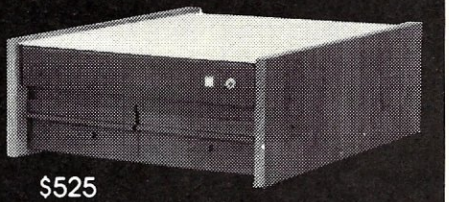

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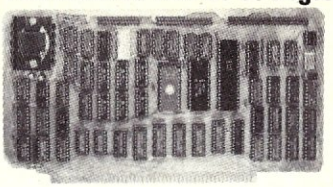

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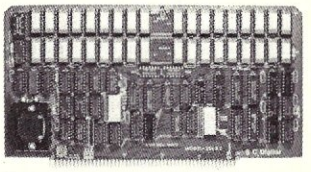

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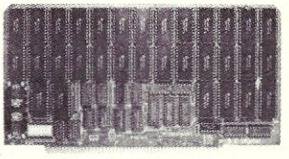

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tionary, they are not added to the dictionaries during a subsequent SpellStar "maintenance" run. In my case, I was proofing and adding from alphabetized word lists, and I found that the first fifteen "unmatched" words of any list were not being added to the dictionaries as I had specified.

The 10-step bug repellant

There is, however, a good, workable way around the problem. It's not a fix in the sense of changing the program to eliminate the error condition; it's a procedural change that simply sidesteps the problem and makes it possible to never see the error message or the condition that causes it. Briefly, the procedure is to ignore the "automatic" editing capability that returns editing control to WordStar immediately after leaving SpellStar. Instead of going ahead with the final editing and correcting pass, the document is "abandoned," apparently clearing the memory areas causing the problem, and a new editing pass then is started from scratch. Specifically, the steps to be performed are:

1. Create, edit, and prepare the document in the normal fashion with WordStar.
2. Enter and use SpellStar in the normal manner (from the WordStar "No Files" menu). Note the total number of words in the file being proofread. If the number is greater than 1500, the following remedial procedures will prevent the internal error. If the number is less than 1500, the error probably will not occur and you can proceed in the normal fashion detailed in the WordStar/SpellStar manual.
3. Exit SpellStar and return to WordStar just as you normally would. You'll be in the edit mode with the cursor positioned on the first word not found in the dictionary. At this point, your original document is stored on disk under its original name, but there is another file on disk with a .@@@ extension, and it is this file that contains the marked words that need to be edited.
4. Ignore the spelling-correction prompts and type a CTRL-U to interrupt the function. Then strike the ESCAPE key to regain keyboard control.
5. Type CTRL-K Q to quit the editing function and answer the question about abandoning an edited document with a Y (yes) to exit back to the "No Files" menu. Do not use a CTRL-K D or CTRL-K S command to save the document—the spelling mark for the first word was deleted by WordStar, so if you save the file you lose the first word. You just want to quit without saving or resaving anything more.
6. At the "No Files" menu, use the "Y" function to erase the file with the .ADD extension. This is an optional step, but it does eliminate any preexisting record of an action to be taken on the first word in the document and tends to make the subsequent editing pass a little cleaner.
7. At the "No Files" menu, select "document editing" by typing a D. When asked for the name of the file to edit, answer with the document name having the .@@@ extension instead of the original document. This will cause editing of the file that has been marked by SpellStar.
8. When back in the editing mode, type a CTRL-Q CTRL-L sequence to restart the spelling correction operation, and answer the subsequent prompt with a G to start the corrections at the beginning of the file.
9. The cursor should be back at the first word in the file that SpellStar was unable to match to a dictionary entry. From this point proceed to correct and edit the spelling just as you normally would. When done, save the document with a CTRL-K D command, returning to the "No Files" menu. At this point, the file with the .@@@ extension is the fully corrected version of your document, and the original unchanged version remains under its original name.
10. Erase the original file name (the uncorrected file) and rename the corrected file having the .@@@ extension to whatever you want to call it. The file with the .ADD extension then may be used to update the SpellStar dictionaries as described in the manual.

This may sound like a lot of trouble, but I find it far preferable to having the system hang or fail to add desired words to the SpellStar dictionary. Since adopting this modified procedure, I've never encountered the internal error message again, regardless of how long my text files have been or how many corrections and dictionary additions have been required. It may not be exactly as MicroPro intended, but it does work.

Note: *WordStar and SpellStar are registered trademarks of MicroPro International.*

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CIRCLE 194 ON READER SERVICE CARD

A Flexible Solution to the Large BIOS Problem

by Andrew L. Bender

The six sectors provided by Digital Research into which one is supposed to cram all of that good stuff alluded to in the CP/M Alteration Guide just never seem to be enough. As I finished my four-disk 64K BIOS for my old Altair 8800, I noticed that I had no room for my list device drivers and that the sign-on message or the routine that caused it to be printed had to go. In plain talk, I was out of space.

My solution to this problem was exhaustively tested and subjected to use for about two months before I submitted this revised set of notes. Although this system was tested only under CP/M 2.2, it *should* work under CP/M 1.4 as well—although the extra unused sectors in the second track of CP/M 1.4 might make the need for this type of system less pressing.

My objectives in fixing my BIOS were twofold: First I had to get the printer-driver for my Decwriter III into the BIOS without increasing the number of BIOS sectors or system tracks. The disk had to be perfectly CP/M-compatible. Second, there could be no special operating procedures, or "farbeling." The system had to look and act just like "plain vanilla CP/M." Any casual user, used to CP/M, had to be able to use it just as if it the entire system were contained in those two system tracks.

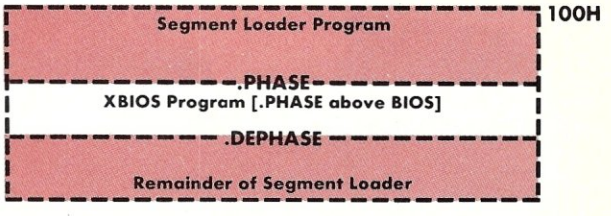
I began investigating the possibility of putting the extra parts of the BIOS in a separate COM file and then loading this file with CP/M just after cold boot. I would allow the condition that this COM file had to be present just as if it were a processor or other program like PIP or SUBMIT. The question was how to load this file smoothly and unobtrusively. I read several articles on CP/M's undocumented "Autoload" feature. The most recent and best explanation was in *Microsystems*, Vol. 3, No. 1, by Kelly Smith. I reasoned that this feature could be used to force CP/M to load and execute a program that could get my extra BIOS loaded. In keeping with current terminology, I called this extra BIOS "XBIOS," and the loader program that is executed to get it into memory, the "segment loader."

By assembling the XBIOS into the segment loader, I got the entire package into a single COM file. I used the area above the BIOS to put the XBIOS. This area, which is used for tables associated with the disk input/output control system, is actually quite large in many systems.

First, you should calculate how much free space you have up there above these important tables. This will depend on two factors: the total number of mass storage devices configured, and the amount of memory needed for each device. For each single-density 8" flexible disk you must allocate 47 bytes. Sixteen bytes are used for the check vector and 31 bytes are used for the allocation vector. If you use double-density disks, two-sided disks, or a hard disk, you will not be able to use 47 bytes but must figure out again what this value will be.

Second, you need to put aside 128 bytes for a directory buffer, and perhaps additional space if your system uses a blocking and deblocking scheme that needs other buffers. Add up all of that, and you will be able to see how much space you will use above your BIOS. If you are lucky, you will still have quite a generous area of memory to put your XBIOS into.

Using the information above, you will now know if you should continue reading—if you have no space, just turn to the next article. I prepared my segment loader using the Microsoft M80 assembler. This assembler has a very useful set of pseudo-operations known as ".PHASE" and ".DEPHASE". These two pseudo-operations allow an assembly language program contained between these two pseudo-operations to be assembled as if it were *located* at a different address when, in fact, it is actually contained within an assembly language program being assembled at another address, independent of the ".PHASE" address. The ".PHASE" pseudo-operation specifies, in its operand, at what address the program between it and the closing ".DEPHASE" will be assembled, and the resulting machine code appears in the assembly containing the ".PHASE—.DEPHASE" as if it were nothing more than some data assembled with some "DB" instructions. The XBIOS was assembled between the ".PHASE—.DEPHASE" operations within the outer shell of the assembly of the segment loader. In a schematic way this appeared as:



Notice that the XBIOS appears within the segment loader because as the assembly progresses, that is exactly where it is placed. In this spot it is a "program within a program" and it need not be in the middle of the segment loader. It could just as well be at the beginning or the end. Only the addresses in this ".PHASE—.DEPHASE" region refer to areas outside of the segment loader. In my system the segment loader is loaded by CP/M as if

Andrew L. Bender, M.D., Neurological Services, Inc., 336 Center Avenue, Westwood, NJ 07675

it were any other program. When the segment loader gets control, it transfers the XBIOS up into the area of memory above the BIOS. It then alters the appropriate addresses in the BIOS jump table to point to the addresses in the XBIOS, initializes the XBIOS if necessary, and returns control to CP/M. Just like "plain vanilla CP/M," the segment loader loads at 0100H, and execution of the segment loader begins at this address.

There are beneficial "side effects" of an XBIOS. The first and most important side effect is that it is not necessary to generate a new CP/M system each time some new feature is to be checked out or designed. Just patching the features into the XBIOS will ensure that they get checked out in the proper environment and under easier working conditions. Another side effect is that it is possible to design a segment loader that can select one of several different XBIOS programs, depending on an operator message or perhaps a response gained from one or more input channels.

The Autoload feature in CP/M is not really useful for getting the segment loader loaded and executed. In the Autoload feature, the console command buffer that occupies the sixth to the 135th byte in the console command processor (CCP) is preloaded with the name of a command file which the programmer desires to be loaded on each occasion when the CCP is loaded.

The first byte of the command buffer always contains the value 7FH, indicating to the system that the length of the console command buffer is 128 bytes in length. The second byte of the console command buffer contains the length of the command file name that follows it. The actual ASCII characters of the command file name follow this second byte. If you recall, this is exactly the format of the buffer required by the CP/M control function 10—Read Console Buffer. When the CCP gets control, it will examine this console command buffer and load and execute the command file associated with the name in the console command buffer. In order not to violate your CP/M license agreement with Digital Research, you should not overwrite the text of their copyright message in the console command buffer. There are 16 blanks before the start of the copyright notice. You can move their message down if you need more space.

If the CCP is altered as directed in the article by Kelly Smith, then the command file name kept in the console command buffer will be executed each time the CP/M system jumps to "BOOT", or the operator does a CTL-C from the keyboard, or a program calls CP/M with a function code of zero. This probably would not cause harm in many cases, but it sure is inefficient having to load and execute the segment loader each time one of these functions is carried out. It would be much nicer if you could just execute the segment loader on a "cold boot."

If you use the cold boot entry into your BIOS to move the name of your segment loader into the console command buffer into the CCP, you have the problem licked, because the CCP as it is loaded from the system tracks of your CP/M disk contains nothing in the console command buffer. You are going to "jam" something into that buffer that will be overwritten as soon as the CCP gets reloaded. The console command buffer begins at CCP+7; at that address you need to store the length of the filename of the XBIOS segment loader. For example: XBIOS64.COM would require storing a '7' in CCP+7 to represent the length of XBIOS64. In the memory addresses CCP+8 and following you would store the characters "XBIOS64". When your BIOS jumps to CCP after the cold boot, the file XBIOS64.COM would be loaded and executed. Since the name is *not* built into the CCP, as it would be under the use of the "Autoload" feature, rebooting the system *does not* reload XBIOS64 because the name is *not* in the CCP—it is moved there by the cold boot entry of the BIOS.

Now you have the mechanism for building a system with an XBIOS. Since many tasks performed by the BIOS are initialization tasks that need to be carried out once on each cold boot, these tasks can be put in the segment loader where they *do not* occupy permanent memory. You just have to be careful, in laying out these tasks, that you do not depend for booting on a device that is only there or only initialized after the segment loader has been executed. You should investigate very carefully just what tasks need to be "up and running" before segment loading. Of course the disk driver (at least the disk read routine) must be in the BIOS, but disk write need not be. You could put that in the XBIOS, since you do not need it to bring up the system. Console output needs to be in the real BIOS, but console input may be able to reside in the XBIOS if you do not need it for handling disk errors or setting up things in the BIOS. Dividing up the BIOS like this is essential for the best use of memory space. You can put all one-time initialization into the segment loader itself, completely out of the XBIOS.

The sample BIOS patches (Listing 1) and XBIOS (Listing 2) included below show how to put the system together so that it works. My XBIOS contains a byte at the beginning that has either a zero followed by a two-byte address or nonzero byte at the beginning. If the first byte is zero, it signals the segment loader that the XBIOS contains code that needs initialization on loading. The segment loader obtains the address contained in the two bytes following the zero byte and stores it in the operand address of a call instruction that is executed after the XBIOS has been moved to its destination above the BIOS. This call instruction thus becomes the call to an initialization subroutine to set up the XBIOS. Because the initialization code need not reside in the XBIOS, valuable

There are beneficial "side effects" of an XBIOS: It is not necessary to generate a new CP/M to test a new feature—just patch it into the XBIOS.

memory locations are conserved. After the segment loader has executed, the return address to CP/M is fetched and the segment loader returns to CP/M.

Listing 1

```
; refer to CP/M 2.2 Alteration Guide Appendix C Page 51.  The
; Address 4A9C marks the start of the coding for cold boot under
; the label "BOOT"
; patches to bios
;
;insert before "JMP GOCPM" in the "BOOT" code:
;
     mvi  b,lstr     ;length of stuff to go into ccp buffer
     lxi  d,xiocom   ;system call
     lxi  h,ccp+7    ;
loop:ldax d
     mov  m,a
     inx  d
     inx  h
     dcr  b
     jnz  loop       ;transfer image to ccp buffer
;
;segment loader name patch (put this out of the way someplace)
;msize parameter forms proper name for system size.
xiocom: db     lstr-1
     db   'XIOS'
     db   '0'+(msize/10),'0'+(msize mod 10)
lstr equ  $-xiocom
;
;end of bios patches
;
```

Once the BIOS patches have been inserted in your CBIOS, you should have your copy of the the appropriate XBIOS for your system size on the system disk. If you don't have the XBIOS out there on the disk and you do not use the facilities provided by the XBIOS, only a harmless ?XBIOS message will appear when it is to be loaded by the CCP from the disk. If you use the facilities without having them loaded, then anything can happen. You might want to code all addresses in the CBIOS jump table that refer to XBIOS routines to jump to an error address. When the XBIOS overwrites these addresses, you will go to the proper routine. This kind of defensive programming always pays off. While checking out my system, I got into the disk write routine once and overwrote some disk space because I did not have the error traps in my CBIOS (I confess: I overwrote the directory and could not use the disk after that!).

Listing 2 is a skeletal system only. It was designed to demonstrate "How to do it" and not how it was really done. The calculation of the various disk parameters and system sizes are given in detail in this listing. You should refer to them and study them carefully before modifying your system. If you want the entire system, it is available through the SIG/M library.

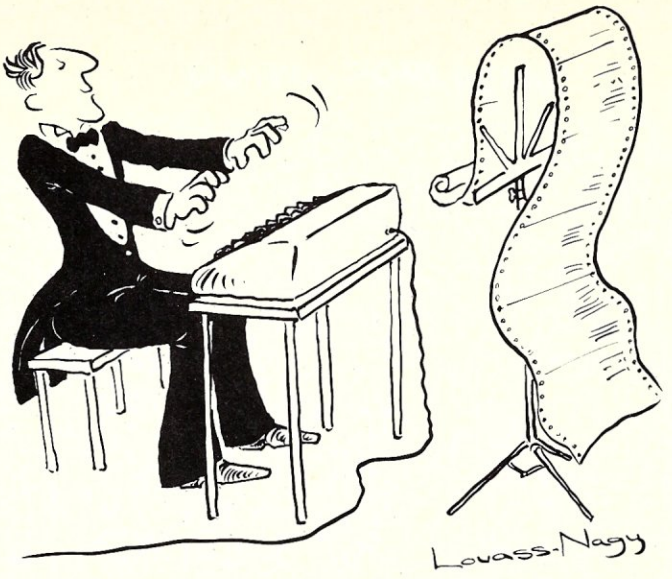
M80 and Microsoft refer to products of Microsoft, Inc. See page 20 for more on SIG/M.

SIG/M
Box 97
Iselin, NJ 08830

Andrew L. Bender practices medical neurology and has over 20 years of experience in computer programming. His last birthday was too long ago to be considered in living memory.

Listing 2

```
                        ;sample xios
                        ;this program is public domain
                        cseg
0040'                   msize   equ     64      ;memory size to configure xios for
0004                    ndisks  equ     4       ;number of disks in the system
0010                    ckvsz   equ     16      ;check vector size
001F                    alvsz   equ     31      ;allocation vector size
                        ; above values configure 8" single density disk
002F                    dpkt    equ     ckvsz+alvsz     ;size of diskpacket
0010                    conch   equ     16      ;console channel on 2/sio
001A                    prnch   equ     1ah     ;printer channel on 2/sio
0011                    xon     equ     011h    ;X-ON from printer
0013                    xoff    equ     013h    ;X-OFF from printer
00C0                    modem   equ     0c0h    ;modem address
0012                    spare   equ     18      ;low speed print channel
0012                    lschan  equ     18      ;low speed channel
0300                    lbios   equ     300h    ;length of bios
0080                    dvctl   equ     128     ;length of directory vector
0010                    slop    equ     10h     ;patch space
                        ;cp/m parameters - see Alteration Guide For Details
0400                    bias    equ     (msize-20)*1024
E400                    ccp     equ     3400h+bias
E407                    buffer  equ     ccp+7   ;Address of ccp buffer
EC06                    bdos    equ     ccp+806h
FA00                    bios    equ     ccp+1600h
                        ;origin of XIOS segment:
                        ;-----------------------------------------------
FE4C                    xios    equ     bios+lbios+(dpkt*ndisks)+dvectl+slop
                        ;-----------------------------------------------
                                cseg
0000'                   ios     equ     5       ;i/o supervisor
0003                    iobyte  equ     3       ;intel i/o byte location
0000                    boot    equ     0       ;warm boot
0009                    strprt  equ     9       ;string print function
                        ;
0000' 21 0000           hdwldr: lxi     h,0     ;get stack address
0003' 39                        dad     sp
0004' 22 0039'                  shld    cpmstk  ;from cp/m
0007' 31 0100                   lxi     sp,100h ;preserve it
000A' 01 09                     mvi     c,strprt        ;set stack into low memory
000C' 11 003B'                  lxi     d,stdhms
000F' CD 0005                   call    ios
0012' 21 0097'                  lxi     h,stdh  ;standard hardware drivers
0015' 01 004E                   lxi     b,stdend-stdh
0018' 11 FE4C           ldrhdw: lxi     d,xios  ;load running hardware complement
001B' CD 006A'                  call    move    ;transfer bios to high memory
001E' 3A FE4C                   lda     xios    ;get the first byte of xios.
0021' B7                        ora     a       ;is this byte =0???
0022' C2 0034'                  jnz     init5   ;if not zero then the xios doesnt need initialization
0025' 2A FE4D                   lhld    xios+1  ;it is zero.  the second and third byte are the addr
0028' 22 0032'                  shld    init4+1 ;of a subroutine in the xios to call to initialize it
                                                ;so that it works properly.
002B' 21 0000           IXI     H,0     ;TURN OFF CCP RE-ENTRY IF SYSTEM IS MEMORY RESIDENT
                                cseg
002E' 22 E407           SHLD    BUFFER  ;(IN CASE USEING DIALECT OF FAST OR SPEED)
0031' CD 0000           init4:  call    0       ;address of xios subroutine for initialization
0034' 2A 0039'          init5:  lhld    cpmstk
0037' F9                        sphl            ;return to user's operating system (A>)
0038' C9                        ret
0039' 0000              CPMSTK: DW      0       ;CP/M STACK POINTER
003B' 1B 4B 1B 4A       stdhms: db      27,'H',27,'J'
003F' 36 34                     db      (msize/10)+'0',(msize mod 10)+'0'
0041' 6B 20 54 41               db      'k TARBELL/FD400 CP/M SYSTEM VER 2.0 (,1)'
0045' 52 42 45 4C
0049' 4C 2F 46 44
004D' 34 30 30 20
0051' 43 50 2F 4D
0055' 20 53 59 53
0059' 54 45 4D 20
005D' 56 45 52 20
0061' 32 2E 30 20
0065' 28 2C 31 29
0069' 24                        db      '$'
006A' 7E                move:   mov     a,m     ;move hl to de
006B' 12                        stax    d
006C' 13                        inx     d
006D' 23                        inx     h
006E' 0B                        dcx     b
006F' 78                        mov     a,b
0070' B1                        ora     c
0071' C2 006A'                  jnz     move
0074' C9                        ret
                        ;initialize xios - this routine need not be (and shouldn't be) in xios
                        ;unless you need to do something here each time you go to xios
0075' 3E 03             init1:  mvi     a,3     ;master reset all i/o
0077' D3 10                     out     conch   ;to console
0079' D3 1A                     out     prnch   ;to printer
007B' 3E 15                     mvi     a,025q  ;select byte width etc
007D' D3 10                     out     conch
007F' D3 1A                     out     prnch
0081' 21 05DC                   lxi     h,1500  ;wait until uart settles down
```



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XASMF8	F8/3870	
XASMZ8	Z8	
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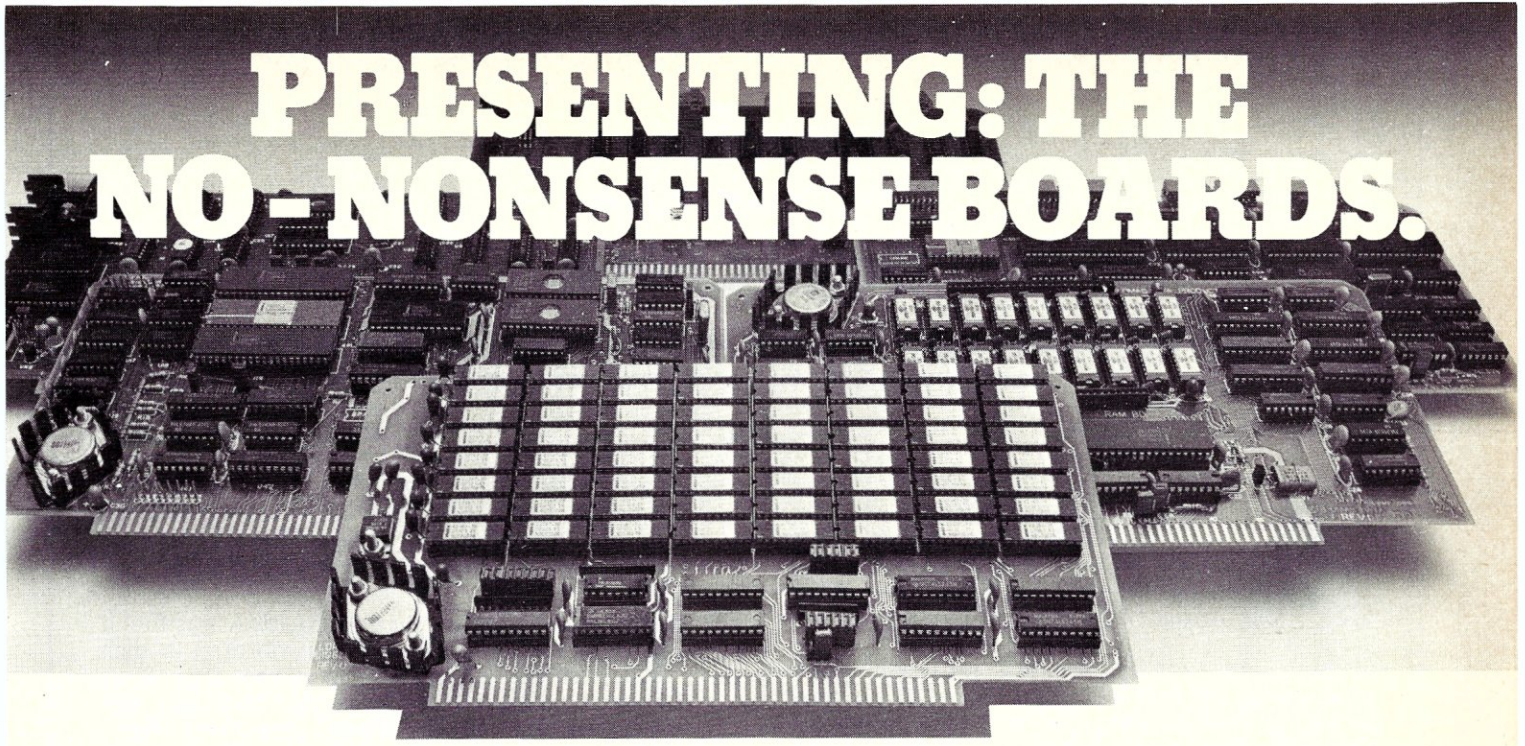
Large BIOS continued . . .

```
0084'   2B              initia: dcx     h
0085'   7D                      mov     a,l
0086'   B4                      ora     h
0087'   C2 0084'               jnz     initla
008A'   21 FE4F                 lxi     h,list  ;plus addresses into BIOS jump table
008D'   22 FA10                 shld    bios+16 ;list driver address
0090'   21 FE54                 lxi     h,listst
0093'   22 FA2E                 shld    bios+02eh ;list device status routine
0096'   C9                      ret             ;end of initialization
                        ;
                        ;end of transient memory routines here
                        ;
                        ;ALL CODE BETWEEN THE LABELS STDH AND STDEND IS THE STANDARD RUNNING
                        ;HARDWARE TABLE CODE THAT IS ALWAYS RESIDENT ONCE CP/M HAS COME UP AND
                        ;DONE ITS FIRST "COLD BOOT" THIS IS THE REAL "XIOS"
0097'                   STDH:;  ************************************************
                                ;       .phase  xios
                                ;
                                ;       ************************************************
FE4C    00                      db      00      ;nop (indicates that loader shouls initialize hdw)
FE4D    0075'                   dw      init1   ;initialization address
                        ;
                        ;list device driver
                        ;non- interrupt code
                        ;
                        ;7/3/82 alb
                        ;
FE4F    CD FE64         list:   call    listst  ;get list status
FE52    C2 FE4F                 jnz     list    ;loop till clear
FE55    7A                      mov     a,d     ;data byte
FE56    E6 03                   ani     03h     ;mask off left 2 bits
FE58    79                      mov     a,c     ;load output character
FE59    CA FE61                 jz      lsl2n   ;jump to ls-120 driver
FE5C    D3 13                   out     lschan+1 ; output on low speed device
FE5E    C9                      ret
FE5F    D3 1A           ls120n: out     prnch+1 ;output to ls-120
FE61    C9                      ret
                        ;
                        ; list status device
                        ;
FE64    3A 0003         liststs: lda    iobyte  ;set fork for different device
FE67    E6 C0                   ani     0c0h    ;and off lower bits
FE69    C2 FE92                 jnz     lstst1  ;jump if low speed printer
FE6C    DB 1A           lcst:   in      prnch   ;get uart status
FE6E    1F                      rar             ;split up uart bits
FE6F    DA FE77                 jc      lcst1   ;if carry bit set ls-120 might be sending DC3 (xoff)
FE72    E6 01                   ani     1
FE74    EE 01                   xri     1       ;toggle transmitter ready bit 0=ready 1=not ready
FE76    C9                      ret             ;return to user code
FE77    DB 1A           lcst1:  in      prnch+1 ;get input data from ls-120
FE79    E6 7F                   ani     7fh     ;mask off garbage bits
FE7B    FE 13                   cpi     xoff    ;did ls-120 set restraint line?
FE7D    C2 FE6C                 jnz     lcst2   ;yes, spin until ls-120 sends xon (dc1)
FE80    DB 1A                   in      prnch   ;get rcvr rdy bit
FE82    1F                      rar
FE83    D2 FE80                 jnc     lcst2   ;just wait here
FE86    DB 1A                   in      prnch+1
FE88    E6 7F                   ani     7fh
FE8A    FE 11                   cpi     xon     ;look for xon
FE8C    CA FE6C                 jz      lcst    ;check transmitter ready status
FE8F    C3 FE80                 jmp     lcst2   ;spin until printer buffer empties
FE92    DB 12           lstst1: in      lschan  ;check low speed channel
FE94    1F                      rar
FE95    E6 01                   ani     1
FE97    EE 01                   xri     1
FE99    C9                      ret             ;just return opposite status
                        ; END OF XIOS SEGMENT   ;**************
0AE5'                           .dephase
                        STDEND:;MARKS THE END OF THE XIOS AND MUST FOLLOW .DEPHASE
                                end     hdwldr
Macros:

Symbols:
ALVSZ   001F    RDOS    ECO6    BIAS    A000    BIOS    FA00
BOOT    0000    BUFFER  E407    CCP     E400    CKVSZ   0010
CONCH   0010    CPMSIK  0039'   DPKT    002E    DVECTI  0080
HDWLDR  0000'   INIT1   0075'   INITIA  00R4'   INIT4   0031'
INITS   0034'   IOBYTE  0003    IOS     0005    IRIOS   0300
ICST    FE6C    ICST1   FE77    ICST2   FE80    IOHMDW  001R'
LIST    FE4F    LISTST  FE64    LS120   FE5I    LSCHAN  0012
LSTST1  FE92    MODEM   00C0    MOVE    00A4'   MSIZE   0040
NDISKS  0004    PRNCH   001A    SIOP    0018'   SPARE   0012
STDEND  0AE5'   STDH    0097'   STDHMS  0038'   STRPRT  0009
XIOS    FE4C    XOFF    0013    XON     0011

No Fatal error(s)
```

PRESENTING: THE NO-NONSENSE BOARDS.



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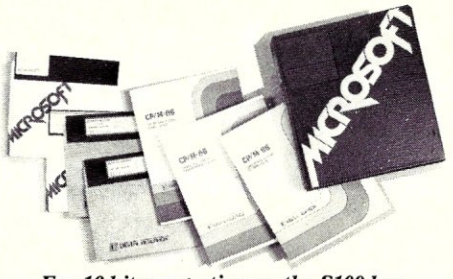

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NorthStar™ Topics

SOFTWARE REVIEW

DIRALPHA

A program to solve two North Star directory limitations: random order, and lack of a sort

by Edgar F. Coudal

A utility that solves annoying and otherwise unsolvable petty problems is one of the little delights in life, like finding a full six-pack in the back of the refrigerator when you thought you'd have to run out in the cold.

Such a utility is DIRALPHA, an assembly language program that takes care of two of the most annoying shortcomings of the North Star Disk Operating System: Its habit of putting new directory entries into the first available slot in the directory even though that slot is somewhere back among the files you created six months ago, and the DOS's inability to sort itself in any meaningful way.

North Star users will attest that a directory on a frequently used disk, such as a correspondence disk or a program development disk, becomes a totally hopeless and disorganized mess after a while.

The seed program for DIRALPHA was found in a crude common-domain form on a disk given the Chicago Area North Star User Group. As with so many disks that find their way into user group libraries, it only ran under a single-density disk controller. Such challenges interest Steve Keith, a group member, author of various utilities, and a user with more than passing knowledge of the DOS structure.

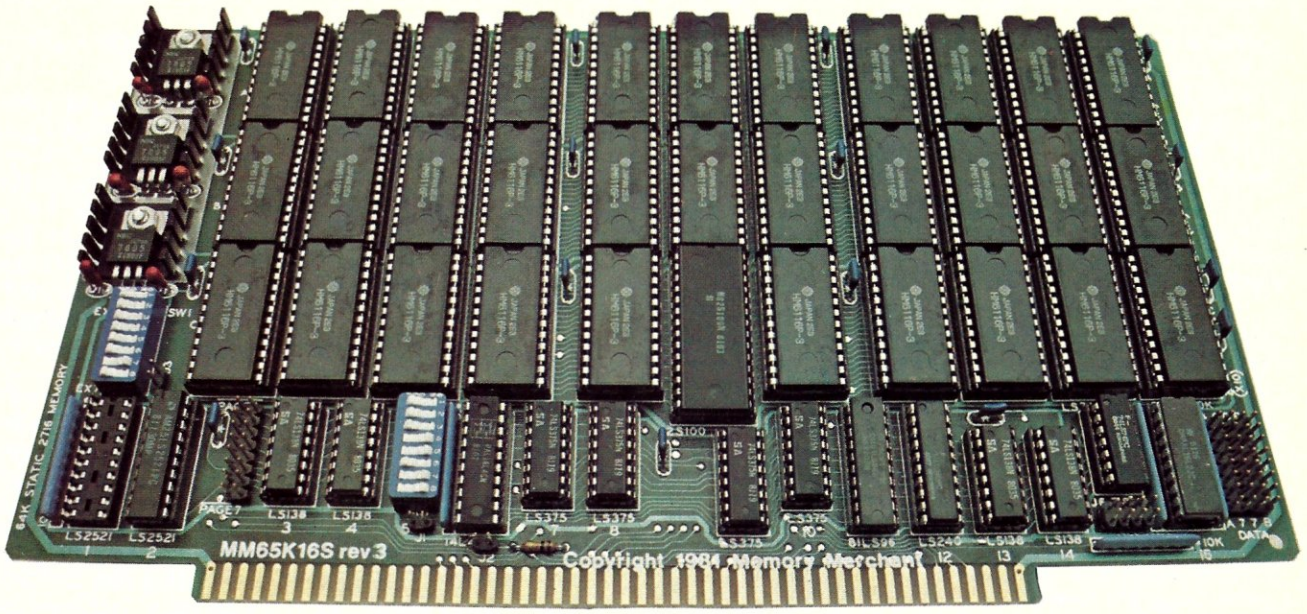
Keith's modification, now known as DIRALPHA, answers both the above needs, without any commands, questions, or possible ways to go wrong, except perhaps by forgetting to load the program.

No commands? Exactly. You place the disk

Edgar F. Coudal, 627 S. Crescent, Park Ridge, IL 60068

```
0000  0E00  0E81
            ; SOURCE FOR SDIR WITH LIST  2/16/82

                  ORG   0E00H
                  EQU   0100H
                  EQU   DOS  + 22H
                  EQU   DOS  + 25H
                  EQU   DOS  + 28H

0E00                                    ; WARM BOOT

0100                                    ; READ,DOUBLE,DRIVE#
0122                                    ; WRITE,DOUBLE,DRIVE#
0125
0128

0181              EQU   0181H           ; DRIVE#1
0081              EQU   0081H           ; 128 FILES

0001              EQU   01H
007F              EQU   7FH

0E00 01 8101 SDIR LXI   B, READ         ; CALL DCOM SET UP
0E03 CD 730E      CALL  SDCOM           ; CALL MAIN BODY
0E06 CD 1A0E      CALL  BODY
0E09 01 8100      LXI   B, WRIT
0E0C CD 730E      CALL  SDCOM           ; CALL DCOM SET UP
0E0F 21 0000      LXI   H, 0000H
0E12 3E 01        MVI   A, DRIV         ; CALL DOS LIST
0E14 CD 2501      CALL  LIST            ; RETURN TO DOS
0E17 C3 2801      JMP   RET             ; MAIN BODY OF PROGRAM
0E1A 3E 7F  BODY  MVI   A, FILE         ; SAVE FILE COUNT
0E1C 32 7F0E      STA   SAVE            ; SET D=16 CHAR/FILE
0E1F 11 1000      LXI   D, 10H          ; SET H,L TO END FOR DIR
0E22 21 800E      LXI   H, DIR
0E25 44           MOV   B, H
0E26 4D           MOV   C, L
0E27 19           DAD   D
0E28 CD 3F0E      CALL  CMPR            ; COMPARE TWO FILES
0E2B D2 340E      JNC   BODY+1AH        ; DON'T SWITCH FILES
0E2E CD 5F0E      CALL  SW              ; SWITCH FILES
0E31 C3 1A0E      JMP   BODY            ; RETURN TO MAIN BODY
0E34 3A 7F0E      LDA   SAVE
0E37 3D           DCR   A
0E38 32 7F0E      STA   SAVE
0E3B C2 250E      JNZ   BODY+0BH
0E3E C9           RET

0E3F E5     CMPR  PUSH  H                 ; / SAVE
0E40 D5           PUSH  D                 ; - ALL
0E41 C5           PUSH  B                 ; \ REGISTERS
0E42 7E           MOV   A, M
```

64K STATIC RAM MEMORY



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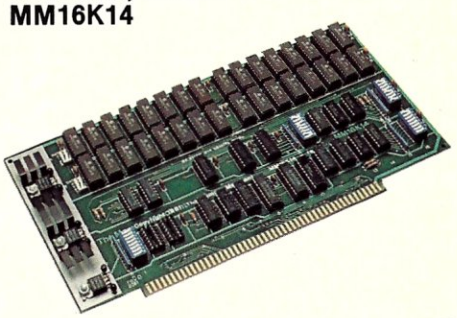

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containing DIRALPHA in Drive 2 and the disk whose directory you want straightened out in Drive 1, then type GO DIRALPHA,2. After a second or two, you see the new directory, alphabetized, and the familiar DOS + prompt. In that brief period, two things have happened:

—The Directory has been read out to memory, alphabetized according to ASCII precedence convention (numbers first, then letters, etc.), and then written back to the disk directory file.

—All the blanks in the Directory caused by killing old files have been removed. Now, any new file saved to the disk shows up at the end of the directory. To realphabetize, simply GO DIRALPHA again.

To complete the cleanup, simply type GO CO from the system disk to compact the entire disk. The program does *not* change any data, nor does it relocate files. It simply reorganizes the Directory so that it makes sense.

The version of DIRALPHA shown in the program listing is written to deal with double-density 5.2 files, which load at E00H. However, modifying the program to run on different systems is easy enough. To change the memory address, simply change the OE00H in the routine source list at the top of the program to wherever your Basic loads (2D00 or 2A00, for instance). Similarly, you may have to change the point where the DOS loads in the second line of the program.

To use DIRALPHA on a single-density system, change line 6 of the source list from 0181H to 0101H, and change line 7 from 0081H to 0001H. Finally, if you are changing the program to run under single density, change line 9 from 7FH to 3FH to reflect the fact that the single-density directory will only hold 64 entries, rather than 128, as the user gets under double density. The body of the program needs no changes once these corrections are made in the routine source list.

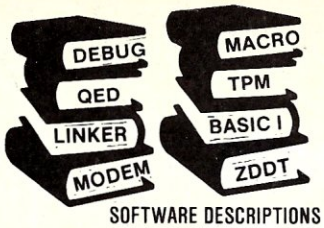
There's a side benefit—one begins to give more thought to what new files are named. In my business, for instance, which is marketing communications for a number of different clients, I have begun naming each file for individual clients with the initial letter of the client's name. An article on Conveyor Accessories' newest product might have been called TITA in the past. Now I call it CTITAN. As a result, all the Conveyor Accessories files on a disk are grouped together after running DIRALPHA.

I think I'll go have one of those beers!

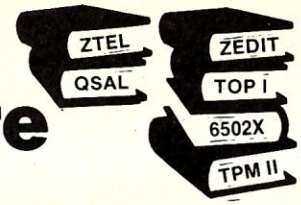
Note: *This program is available from the author on disk for $10.*

```
0E43 FE 20          CPI     20H         ; CHECK FOR BLANK
0E45 CA 5B0E        JZ      EBLK+02H
0E48 0A             LDAX    B
0E49 FE 20          CPI     20H         ; CHECK FOR BLANK
0E4B CA 590E        JZ      EBLK        ; EXIT IF BLANK
0E4E 0A             LDAX    B
0E4F BE             CMP     M
0E50 3F             CMC
0E51 23             INX     H
0E52 03             INX     B
0E53 CA 4E0E        JZ      CMPR+0FH    ; CONTINUE IF EQUAL
0E56 D2 5B0E        JNC     EBLK+02H
0E59 AF             XRA     A
0E5A 37             STC
0E5B C1             POP     B           ; / RESTORE
0E5C D1             POP     D           ; - ALL
0E5D E1             POP     H           ; \ REGISTERS
0E5E C9             RET

0E5F E5     SW      PUSH    H           ; / SAVE
0E60 D5             PUSH    D           ; - ALL
0E61 C5             PUSH    B           ; \ REGISTERS
0E62 16 10          MVI     D, 10H      ; D=16 CHAR/FILE
0E64 5E             MOV     E, M
0E65 0A             LDAX    B           ; / EXCHANGE
0E66 77             MOV     M, A        ; - THESE
0E67 7B             MOV     A, E        ; - TWO
0E68 02             STAX    B           ; \ FILES
0E69 03             INX     B
0E6A 23             INX     H
0E6B 15             DCR     D
0E6C C2 640E        JNZ     SW+05H      ; JUMP IF MORE TO SWITCH
0E6F C1             POP     B           ; / RESTORE
0E70 D1             POP     D           ; - ALL
0E71 E1             POP     H           ; \ REGISTERS
0E72 C9             RET

0E73 11 800E SDCOM  LXI     D, DIR      ; CALL DOS DCOM
0E76 21 0000        LXI     H, 0000H
0E79 3E 04          MVI     A, 04H
0E7B CD 2201        CALL    DCOM
0E7E C9             RET
0E7F 00     SAVE    NOP                 ; # OF FILES SAVE POINT
0E80 00     DIR     NOP                 ; START OF DIR LOCATION

                    ; SAVED AS SDIRCOMN
```

The directory of a frequently used North Star disk soon becomes a hopelessly disorganized mess.



Z80 Software



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	NSDD/Z	North Star Double Density for Zapple I/O
	TRS80-I	TRS-80 Model I (4200H Offset)
	TRS80II	TRS-80 Model II
	VI8	Versafloppy I 8"
	VI5	Versafloppy I 5.25"
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Five Video Display Terminals

A comparative review of the Televideo 925, Zenith Z19, Wyse WY-100, Visual 50, and ADDS Viewpoint 60

by Bill Machrone

Terminals are an integral part of most professional systems. The convenience of choosing the features you want in a display device/keyboard and just plugging it into your RS-232 port is appealing. But the selection of a terminal can be trickier than the specifications would have you believe. This is due in no small part to the large advertising budgets that try to sway your buying decision.

Here we'll look at five terminals, some new, some not so new: the Televideo 925, Zenith Z19, Wyse WY-100, Visual 50, and the ADDS Viewpoint 60. Televideo and ADDS are two of the "Big Four" of terminal manufacturers, the others being Hazeltine and Lear Siegler. Zenith found itself in the terminal business when it purchased the Heath Company; Visual has expanded into general business terminals from the "name-brand knockoff" market (a cheaper DEC-compatible terminal, etc.).

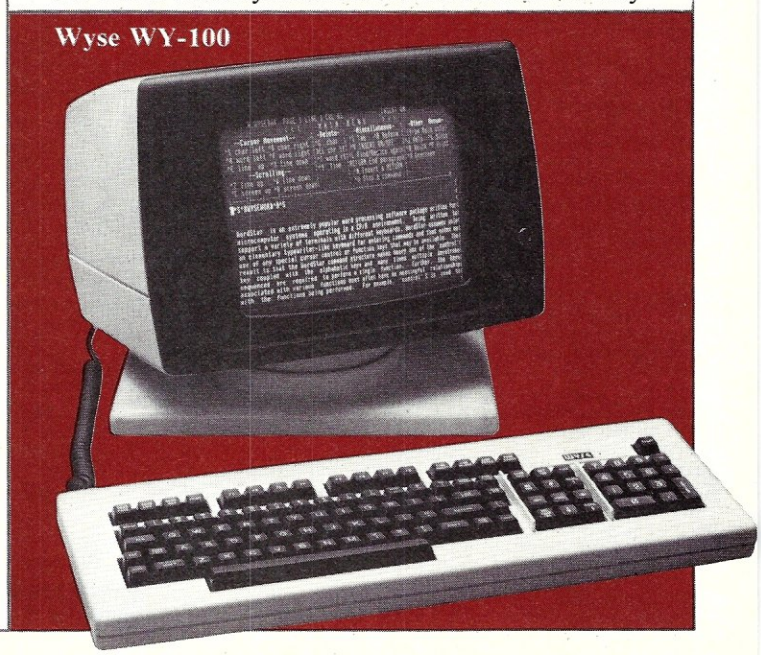
Most of the above terminals are advertised as being "ergonomic," the exception being the Zenith, with its attached keyboard. The rest have separate keyboards, attached by coil cords. Ergonomics has become the biggest buzzword in terminals this year. What most terminal manufacturers mean by this is that they have separate keyboards, period. Other factors that may be considered ergonomic are non-glare screen, low-angle or sculptured keyboard, tiltable or swivelling screen, colored keytops, function and cursor-control keys, and tactile feedback. Indeed, most manufacturers seem to emphasize physical design over any of the performance features of their terminals. It makes sense, then, to begin the comparison with the cases.

Cases

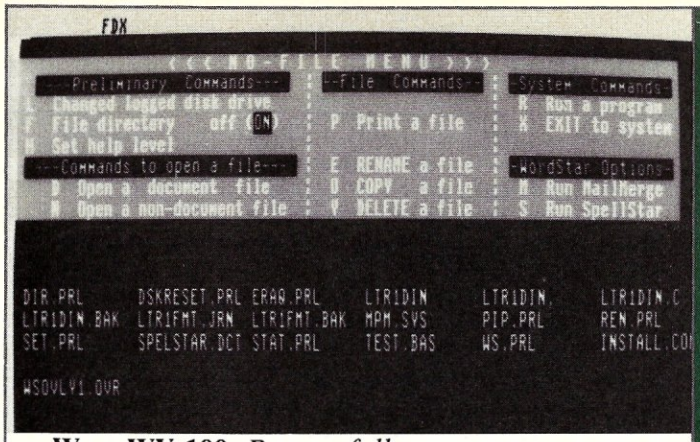
The ADDS Viewpoint 60 is physically identical to the earlier Viewpoint model, with the addition of a row of function keys above the typing area. The case is molded plastic, with a flip-down foot at the rear of the CRT housing that allows straight-line viewing of the screen. This would be handy if the screen were placed on a shelf, but the coil cord, attaching as it does to the back of the CRT housing, is too short to allow such placement. The power switch is also located at the rear of the CRT housing, further limiting freedom of placement. The "footprint" of the housing is admirably small. Style is only one of the many subjective items that I will be reviewing, but most people I've asked agree that the Viewpoint 60 is attractively styled. The lack of mass of the keyboard unit is compensated for by nonskid feet that work well and don't lose effectiveness after picking up the usual desktop dust.

The Televideo 925 has a foamed structural plastic case with a matte finish. The back of the keyboard nestles into a cutaway just below the CRT, permitting the terminal to mimic the nondetached keyboard style. The structural plastic is decidedly more massive than the molded plastic, giving the terminal a hefty, solid feel. The coil cord attaches to the rear and the power switch is located there, too. The terminal's footprint is larger than the ADDS, but small enough to be accommodated by most crowded desktops. It is attractively styled, but less so than the ADDS.

The Visual 50 is a brand-new model in a molded plastic case. The CRT housing is on a plastic pedestal that permits 270° swivelling and an adequate degree of tilt. The bearing surfaces are plastic on plastic, which causes the motions of the CRT head to be somewhat stiff and jerky. On the other hand, the head stays where you put it. The case is designed to house the entire Visual line, and will replace the older sheet metal cases entirely. In a world that has gone crazy over RFI and EMI, that is not necessarily a good thing. The case is designed to accept a 12″ or 14″ tube, making it decidedly larger than the other terminals. The coil cord attaches to the rear, but the power switch is in the front. The keyboard has sufficient mass to stay


Wyse WY-100

Bill Machrone, 121 North Avenue, Fanwood, NJ 07023



Wyse WY-100: *Reverse full screen*

Televideo 925

put, but could benefit from better rubber feet. The terminal, taken by itself, is attractively styled, with a certain angularity lacking in the others. When placed next to the others, the CRT head looks large and bulky.

The Wyse WY-100 is the only terminal in the group to sport a metal (cast aluminum) case and keyboard. Its lines are smooth and well-integrated, making it the beauty contest winner. The CRT head is on a ball-type swivel with nylon gliders. The head turns easily in any direction, limited only by the cables and power cord. The gliding motion, if anything, is too easy, as moving the keyboard to a new position often will move the head. A longer coil cord would partially compensate. The coil cord, as in the others, attaches to the rear. An integrated on-off/brightness control is on the face of the CRT housing. The footprint of the CRT head is agreeably small, but the keyboard is enormous. More on this later.

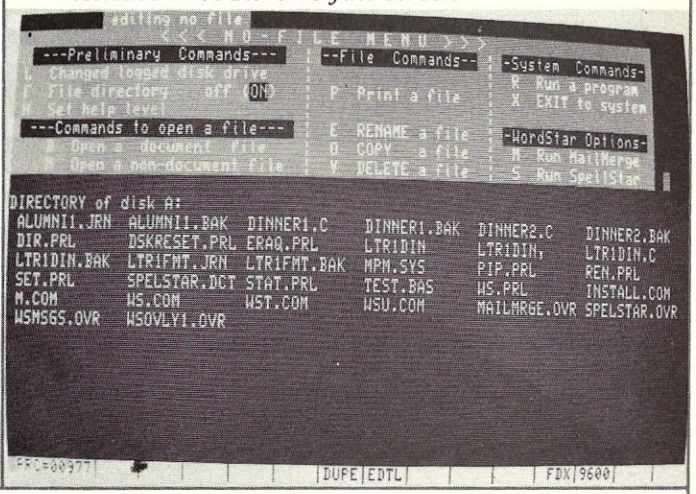
The Zenith Z-19 is the grande dame of the lot, having been in production virtually unchanged since 1979. It has a molded structural foam case, giving it a solid feel. The attached keyboard is well integrated with the CRT portion. The power switch and brightness control are on the rear of the case. It is the only terminal of the group to come with an RS-232 cable. The terminal is well styled compared to some of its forebears, such as the ADDS Regent. It looks dated, however, when compared to the models with separate keyboards. There is ample room for a 5¼" drive and a single board computer, as seen in the Z89 and Z90 models using the same case.

Keyboards

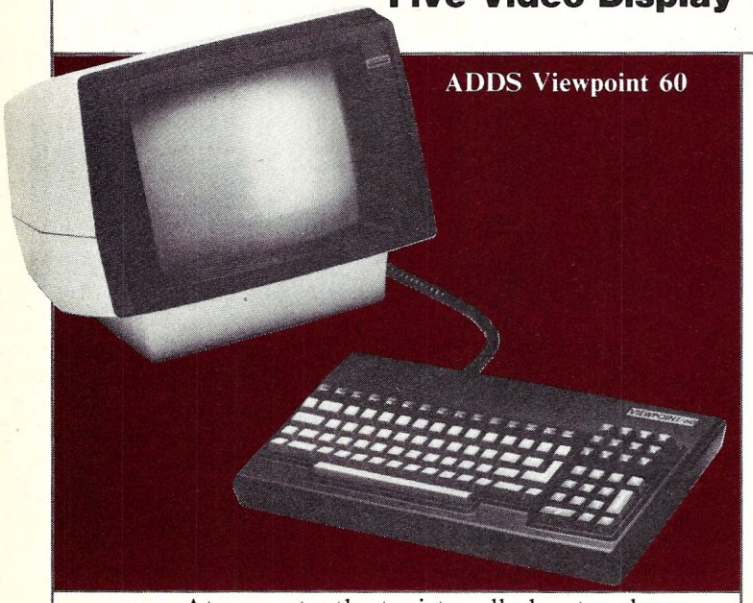
The keyboard is probably the most critical factor for long-term user satisfaction in a terminal. The definition of "keyboard" here is extended to include the support electronics that give it its personality. The microsystems press has periodically been a forum for proponents of alternate keyboard designs, notably the Dvorak. I submit that this is unnecessary, untimely, and unwise in view of the fact that most terminal manufacturers have yet to master the QWERTY layout. There are millions of people trained on QWERTY, many of whom have tried to make a successful transition from the de facto standard (the Selectric typewriter) to one or another terminal. Many competent typists are stymied by the lack of tactile feedback, nonstandard placement of keys, lack of stroke memory, and a host of other design factors. Let's look at how many of the current generation of typists learned their skill:

I can still remember my old junior high school typing teacher at the head of the class, reciting his litany while we cacophonized on a roomful of manual Smith-Coronas. . . . "Keep your back straight, feet flat on the floor. Palms up, fingers arched. Hit the keys like they were hot." Still good advice, but ignored by terminal manufacturers, who forgot the ergonomics that made the advice sound. Manual typewriters and early electrics were like harpsichords—they demanded an incisive, staccato style. The Selectric and electronic typewriters, with their ability to remember keystrokes and have multiple keys in the depressed state simultaneously, permit a more laid back, legato style, like a piano. They still respond well, however, to the earlier approach. Perhaps a better comparison would be between a pipe organ and an electronic

Televideo 925: *Reverse full screen*



Most neophyte users have no idea of the potential offered by properly designed terminals.



organ. At any rate, the typist really has to relearn his or her skills to use a terminal properly. We subjected all of the keyboards to review by highly proficient typists and their observations are merged into my remarks.

The de facto standard, the Selectric, has a sculptured keyboard that economizes on the distance that the fingers have to travel. The actual motion of the key varies slightly from the vertical to allow easy depression of the key. Many early terminals, on the other hand, had nothing more than a couple of rows of momentary contact switches on an angled printed circuit board. Some of the early ones (and some of the current ones) weren't even stepped. The motion of the keys was not vertical but perpendicular to the angle of the keyboard's base. This configuration promotes key binding and a very ponderous keyboarding technique, as the fingertips are forced to "stab" the keys home. Fortunately, this type of keyboard is headed for the last roundup and is not represented by any of the terminals reviewed here. There is, however, a "cheater" version of the old-style keyboard, in which the switches are perpendicular to the angle of the keyboard but the keytops are angled to simulate vertical motion. Careful selection of materials and clearances for the bearing surfaces of the switch can make this acceptable. See the paragraph on the Zenith's keyboard for one that isn't.

The ADDS keyboard layout imitates the Selectric fairly successfully, with a large return key and proper placement of the shift keys. There are no "extra" keys between the characters and the return, a common problem when trying to cram the ASCII characters not represented on standard typewriters into the same general keyboard space. Terminal users have come to expect the escape key to be in the upper left-hand corner and the backspace key in the upper right-hand corner of the keyboard, on the numeric row. The delete key is usually considered to be a "right pinky" function as well, since it is generally implemented as a destructive backspace by most word-processing software, and the Selectric's self-correction key is pressed by the right pinky. ADDS chose to place the delete at the extreme left of the home row, next to the caps lock key. Most terminal manufacturers place the control key in this position, as it allows easy manipulation of "cursor-control diamonds," where cursor movements are effected by the control values of (usually) the E, S, D, and X keys. ADDS placed the control key at the extreme left of the bottom row, which requires a little more of a stretch.

The typists liked the tactile feedback of the ADDS keyboard, even though it doesn't come close to that provided by a Selectric. Each key has a two-stage spring, with light travel until the halfway point, then heavier travel to the bottom of the stroke. This key is made by Keytronics for ADDS and several other terminal manufacturers. The quality of the feedback was dulled somewhat by the lack of rigidity of the keyboard. A full-stroke keypress bends the circuit board slightly—a disorienting experience for the touch typist. The keyboard has **n**-key rollover, an important feature in today's legato typing style. The keyboard chirp provides aural feedback that a keypress has taken place, but it is poorly implemented. The tone is too long in duration, too loud and begins to blend into a single tone during typamatic (auto repeat) keying. There is a volume control potentiometer on the circuit board, which requires disassembly of the keyboard to access. Deeper keytop depressions on the F and J keys help to orient the touch typist.

The Televideo keyboard is a stepped design with no sculpturing. The angle of the keyboard is fairly steep, making it more of a "reach" to go from row to row. It is limited to 2-key rollover—a decidedly substandard feature, considering the changing style of typing. Mechanically, the keyboard is quite rigid, but has no tactile feedback.

ADDS Viewpoint 60: ***Full screen***

```
        editing no file
          < < <  N O - F I L E   M E N U  > > >
  ---Preliminary  Commands---  ¦ --File  Commands-- ¦ -System  Commands-
 L  Changed logged disk drive  ¦                     ¦  R  Run a program
 F  File directory     off (ON)¦  P  Print a file    ¦  X  EXIT to system
 H  Set help level             ¦                     ¦
  ---Commands to open a file---¦  E  RENAME a file   ¦ -WordStar Options-
    D  Open a  document  file  ¦  O  COPY   a file   ¦  M  Run MailMerge
    N  Open a non-document file¦  Y  DELETE a file   ¦  S  Run SpellStar

DIRECTORY of disk A:
 ALUMNI1.JRN  ALUMNI1.BAK  DINNER1.C    DINNER1.BAK  DINNER2.C    DINNER2.BAK
 DIR.PRL      DSKRESET.PRL ERAQ.PRL     LTR1DIN      LTR1DIN,     LTR1DIN.C
 LTR1DIN.BAK  LTR1FMT.JRN  LTR1FMT.BAK  MPM.SYS      PIP.PRL      REN.PRL
 SET.PRL      SPELSTAR.DCT STAT.PRL     TEST.BAS     WS.PRL       INSTALL.COM
 M.COM        WS.COM       WSU.COM      MAILMRGE.OVR SPELSTAR.OVR WSMSGS.OVR
 WSOVLY1.OVR

 CONV                                   A0    ROW 09 COL 77   R40 MODE
```

What most terminal manufacturers mean by ergonomics is that they have separate keyboards, period.

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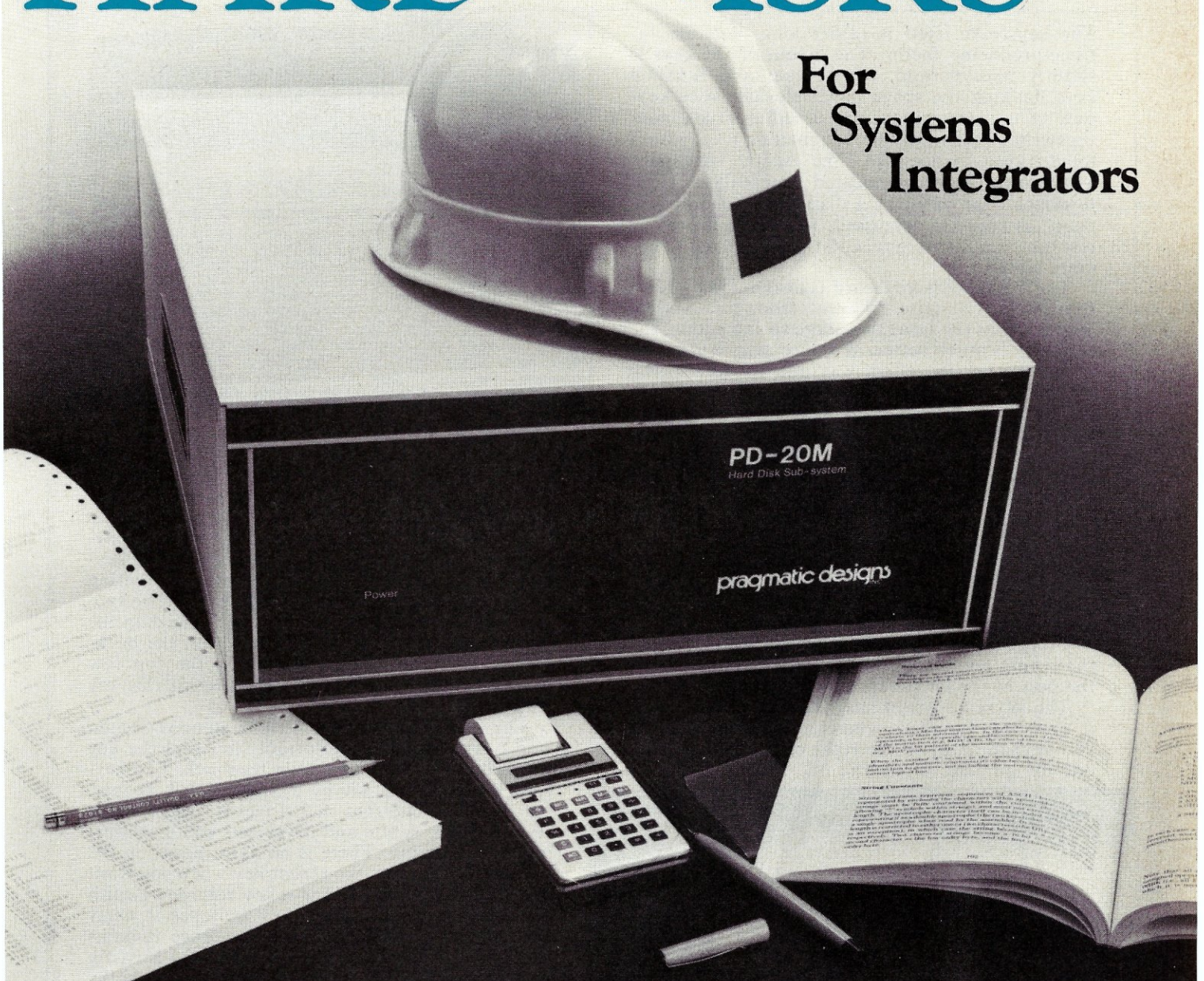

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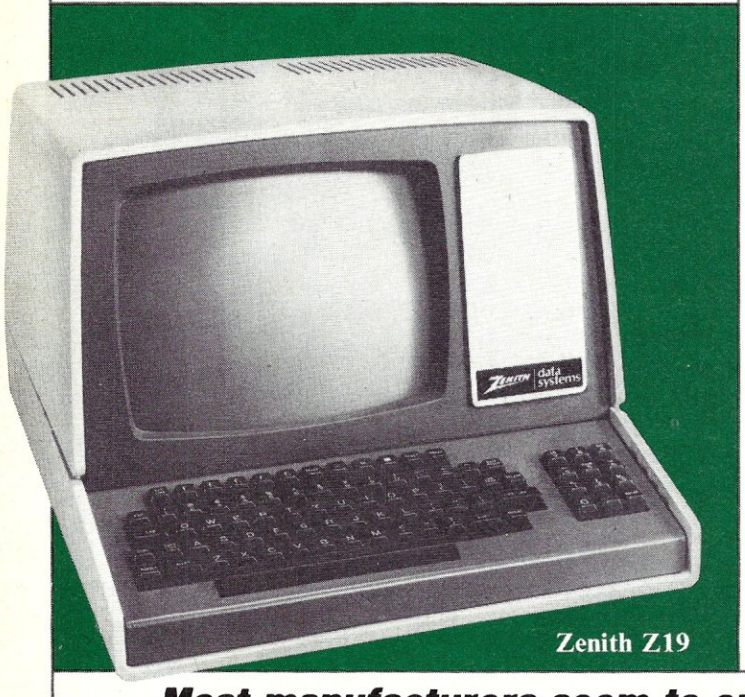
CIRCLE 186 ON READER SERVICE CARD

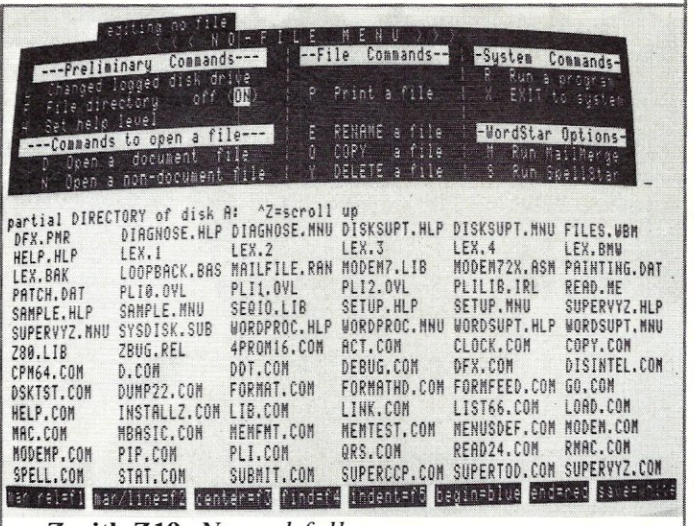
The keystroke itself is rather long—another fatigue-producing factor. The layout of the keys is slightly idiosyncratic, with cursor and function keys flanking the space bar. Televideo uses keytops of a contrasting color to differentiate nontypewriter keys from the rest, making it easy for a touch typist to home in. The escape, backspace and control keys are located acceptably. Aural feedback is provided by a distinctive "boop-boop-boop" as keys are depressed. The sound drove our test typists a little crazy, and they preferred to operate without it.

The Visual 50's keyboard is also made by Keytronics, but is quite different from the ADDS. While it uses the same two-stage spring action, the feedback is much better. We were unable to determine whether the effect was due entirely to the metal stiffening plate that backs up the printed circuit board or to a spring with different characteristics. The keyboard has **n**-key rollover and auto repeat. As in the ADDS, the keyclick or chirp is generated by a piezoelectric beeper, but this had no volume control. The terminal samples that we worked with were all too loud and required that we partially cover the hole on the beeper. The tone, like that of ADDS, was also too long, but did not blur on typamatic keying. The keyboard is sculptured with indented F and J keys. In accordance with the new style of ergonomic keyboards, there is a large palm rest area below the keyboard and the typing angle is quite low. Our typists voted it the best of the lot for speed and comfort.

The Wyse keyboard has 105 keys on it, making it the sheer numbers winner. The keyboard has two keypad areas to the right of the typing area, one for numeric input and one for local editing.



Zenith Z19



Zenith Z19: *Normal full screen*

Unfortunately, there are no visual or tactile cues to help the typist get oriented on the typing area. It is a stepped design, very rigid, with a short key travel that helps to overcome the lack of tactile feedback. The keyclick suffers the same drawbacks as the others using a piezo beeper. The keyboard is some 6″ wider than the others, creating potential problems on crowded desktops. The typing angle is good. The control key is placed on the bottom row, as in the ADDS; however, the backspace key is not the rightmost in the top row (break is there), so that it is hard to hit this key without aiming.

The Zenith keyboard is a rigid, stepped design. The typing angle is comfortably low and the key travel is short, without tactile feedback. The keyclick is generated not by a piezoelectric beeper, but by a 555 one-shot that drives a speaker. It is short enough, subtle and never gets confused during repeat keying. There is no auto repeat on the keyboard; you press the repeat key when you want multiple characters. It has **n**-key rollover. Zenith changed the design of the key switches in early 1982, although the external appearance remains unchanged. The feel of the old keyboard is vastly superior to the new one, which is stiff and balky due to too-strong springs or friction between the shell and the actuator. The contacts on the new keyboard tend to be unreliable, especially the heavily used control and return keys. Fortunately, they are easily fixed by prying off the keycap and bending or cleaning the exposed contacts. All the keys are in the right place, with the exception of the curly braces, which lie between the apostrophe and return keys. This requires an extra reach for the return key. The typists voted the old keyboard one of the best for fast typing, the new keyboard only fair.

Character set/Video quality

You might think that character generation and

Most manufacturers seem to emphasize physical design over any of the performance features of their terminals.

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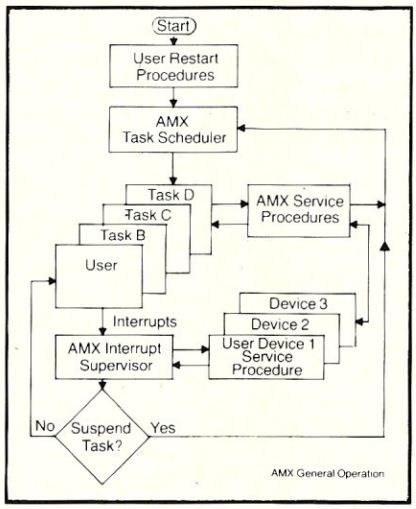

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CIRCLE 176 ON READER SERVICE CARD

video display were such well-known skills that all terminals would be uniformly excellent. Unfortunately, this is not the case. I found tremendous variations in video quality, not only from brand to brand but even from terminal to terminal.

The ADDS Viewpoint 60 is at the bottom of the list in visual quality. Poor video bandwidth creates smeared horizontal dots and vertical gaps between dots that adjustments could not correct. This results in bright horizontal strokes and dim vertical strokes, giving variable contrast to each character. This caused eyestrain to our users. Reverse video shows a pronounced raster, making it unpleasant for use. The standard screen is a non-glare green phosphor. In addition to the ASCII character set, there is a "business graphics" set that allows forms to be drawn on the screen.

The Televideo visual presentation is quite good. Its unique serif-faced character set looks sharp in both normal and reverse video. The quality of the image appears to be repeatable from unit to unit. It also has the business graphics line drawing character set. The standard screen is non-glare green phosphor.

The Visual 50 is in a class by itself for visual quality; the character set is unusually clear and sharp. Indeed, it begins to approach the clarity of the mask-generated IBM 3270 characters. Reverse video is almost free of raster, as though it were interlaced. The characters also give the impression of being larger than they really are, due to their clarity. It, too, has a business graphics character set. The standard screen is white non-glare phosphor, with green available as an option. The only thing I found worth adjusting after uncrating several copies of this terminal was the angle of the yoke on one of them. The video board in the Visual, by the way, is made by Zenith.

The Wyse terminal suffers from some of the same problems as the ADDS, although not to the same extent. The characters were noticeably sharper in reverse video mode than in light on dark. I am generally opposed to this mode of operation because it is like looking into a flashlight. The adjustments took some tweaking in the samples I tried before they were at their best.

Like the keyboard, there are old and new video boards and tubes in Zenith terminals. The old board was designed by Heath and was quite good, with the exception of a tendency towards fuzziness at the extreme corners of the CRT. It seemed to be more of a yoke design problem then deflection circuitry. The new board is designed and built by Zenith and has better video bandwidth, giving sharper, more consistent dots. The standard screen is now green non-glare instead of the white polished tube. The Zenith has a unique set of graphic shapes that are okay for business graphics but, unlike the others, are sufficiently varied to make game programming conceivable. I've seen Star Wars (shoot down TIE fighters), backgammon, and even Pac-Man running on the Z19.

Visual 50

Operating features

Operating features are where the advertising and marketing people have their field day. Many of the hyped features are actually limitations or even useless. The definition of useless is anything that can't be used in the microcomputing environment. Let's take the hackneyed phrase "programmable function keys" as an example. This one is getting right up there with "user friendly" as an irritant. You see, what the terminal designer said to the marketing guy was, "program function keys." The marketeer simply assumed that he was listening to another engineer who couldn't speak English and bent the phrase to his own uses.

There is still only a handful of terminals with true programmable function keys, where you tell the terminal what to transmit when you push a specific key. All of the terminals here have function keys that transmit predetermined sequences. If you write your own programs, it is easy to integrate these keys into their operation. Most commercial software, however, permits only one definition for a particular function. Therefore, if you would like your word processing software to respond to both the control-E and the "up arrow" keys to move the cursor up, you have a problem. A few products can be patched for multiple definitions, but they are in the minority. For instance, I have a dynamite version of WordStar for the Z19 that uses all of its function keys. But it took a long time to do, and I have to redo it every time MicroPro comes out with a new version. Memory is cheap. Has been for years. Programmable function keys are the answer to many programming and user convenience problems.

Now then, if a someone asked you if you wanted a smart terminal with editing features or a dumb terminal, which would you choose? The former, I'm sure. All of the terminals we're talking about

Selection of a terminal can be trickier than the specifications would have you believe.

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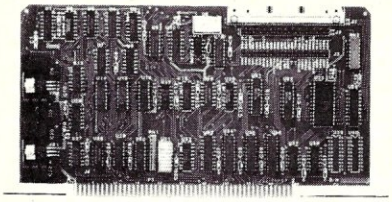

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here are considered "smart," and they all have local editing features. That means you can take the page of text displayed on the screen, move the cursor around and add, change, or delete text. Then you can transmit the modified text back to the host computer. All of which is useless in the microcomputer field, since there is *no* software that utilizes any of these talents.

Want to hear about dumb? All of these terminals offer some form of video enhancement. The list includes normal, reverse video, blinking, underlined, half intensity, and blank. Some support simultaneous combinations of the above (where not mutually exclusive). Trouble is, that three of our subject terminals require a byte of display memory to turn on or turn off the desired attribute. These attribute bytes appear in the display memory as blanks. If you inadvertently write over an attribute byte with a character, it disappears and the attribute is destroyed. Pardon my rancor, but this is the dumbest design imaginable to be foisted on the terminal user. Sure, you've been to computer shows or stores and seen the gee-whiz terminal demo running on a Televideo. Did you ever try to program one? What a mess! Word processors, in particular, cannot tolerate attribute bytes in the middle of text areas. Therefore, the only attributes that can be used for emphasis with the Televideo and WordStar are full and half bright, with half bright as the emphasis mode. Not too bright. The Wyse allows you to use reverse and normal or bright and half bright, but reverse and normal only works if the entire screen is reverse video, with light-on-dark emphasis areas. This is really tough on the eyes. The ADDS wins the dumb attributes contest by permitting *no* attributes to work successfully with WordStar. If you thought WordStar with dim-and-bright was bad, wait till you've seen it with no highlighting.

The Zenith allows you to turn reverse video on and off anytime you want, in as many places on the screen as you choose. The Visual 50 says that you have two kinds of characters, foreground and background. You don't have to leave attribute bytes between them. You can use any of the half-dozen attributes for either background or foreground, and the terminal remembers which was used for each and saves them as defaults to be used in the future. The only system I have seen better than this is that of the Ann Arbor Ambassador terminal, which permits you to turn any and all attributes on and off at will, in any combination, without giving up any screen positions. The foreground/background scheme is also used by Televideo and Wyse, but not with all attributes or combinations of attributes.

Now that I've gotten that particular pet peeve out of my system, here's a rundown on the other features offered by the terminals:

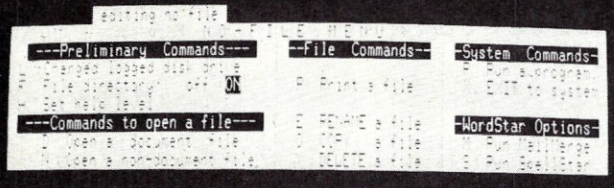
The Viewpoint 60 has a printer port that can either accommodate dumps from the screen or straight-through printing from the computer. As with all the others offering a printer port, it has adjustable baud rates and provisions for handshaking with the printer. You set up the options from an options status line, using the cursor controls to position the desired attribute or operating mode, then toggling the mode on or off with the up/down cursor controls, which display as ones or zeroes on the options status line. The terminal has an operating status line that tells you the row and column you are in and its operating mode. If there is a way to disable this line, I haven't found it. The line cannot be written to. The terminal can be made, through setup, to emulate the older ADDS Regent 40. Although it is specified to run at 19,200 baud, it is likely that you will lose characters at that speed. It has a "form" mode that enables you to build a screen with accessible and nonaccessible areas for block entry and transmission. Custom software is required at the computer to use this type of feature.

The Televideo has a printer port with handshake provisions, as with the others. The status line can be made visible or invisible by alternate strokes of the setup key (with shift held down).

The Visual 50 also sports a printer port supporting screen dump or pass-through printing. The terminal will emulate a Hazeltine 1500, Lear Siegler ADM-3, or ADDS Viewpoint. Its native mode is an extended VT-52 set of escape sequences and functions. Its setup mode is from three menus, each generated internally. To change a particular option or attribute, you just push the number indicated on the menu. It then indicates the new status of that attribute on the screen. The 25th status line contains cursor position and operating mode information and can be made to disappear with a single keypress in setup mode. The line cannot be written to. It supports block mode transmission, if desired. It drops characters at 19,200 baud.

The WY-100 has the same printer port features mentioned above. Its setup is done through dip switches, accessible through a hatch underneath the nameplate on the keyboard. In addition to

Visual 50: *Normal full screen*




```
partial DIRECTORY of disk C:  ^Z=scroll up   ^W=scroll down
 ED.PRL        ERA.PRL       ERAQ.PRL      MPMSTAT.PRL   PIP.PRL       PRINTER.PRL
 PRLCOM.PRL    RDT.PRL       REN.PRL       SCHED.PRL     SDIR.PRL      SET.PRL
 SHOW.PRL      SPOOL.PRL     STAT.PRL      STOPSPLR.PRL  SUBMIT.PRL    TOD.PRL
 TYPE.PRL      USER.PRL      DISKSTAT.PRL  MODE.PRL      BACKMSGS.PRL  DDT.COM
 GENHEX.COM    GENMOD.COM    GENSYS.COM    LOAD.COM      MPMLDR.COM    LINK.COM
 LIB.COM       RMAC.COM      XREF.COM      SETUP210.COM  MPMSETUP.COM  D.COM
 PIP.COM       L80.COM       CREF80.COM    DCASR.PRN     RELDUMP.COM   DDL1.OVL
 RCV.COM       CNV.COM       MLINK.COM     MRENAME.COM   SYSTEM.DAT    WSU.COM
 WSMSGS.OVR    WS0VLY1.OVR   WS.COM        INSTALL.COM   QRS.COM       BACD.REL
 SAMPLE.COM    QRS0.OVL      MODE.COM      AFP.COM       DCASR.REL     DCASR.BAS
 BASCOM.SUB    BASCOM.COM    BASLIB.REL    BRUN.COM      BCLOAD        OBSLIB.REL
 M80.COM       LIB80.COM     DCASR.COM     CPMDMS.REL    BASCOM80.REL  QRS1.OVL
 DOCUMENT.REL  DCASR.DAT     SC.DAT        DOCUMENT.ADD  DOCUMENT.COM  QRS2.OVL
```

Many of the operating features hyped by advertisers are actually limitations, or even useless.

block mode capabilities, the screen can be split vertically or horizontally wherever you want. Each terminal is then independent of the other, selectable by escape codes. There are two status lines. The one at the top is separated from the display area by an underline the width of the screen and displays the terminal's operating mode and status. It also has a message area 40 characters long that can be written to. The other line is at the bottom of the display area (which is still 24 lines) and is intended for labeling function keys. I'm not sure which of the lines irritated me more. The one at the top cannot, as far as I can tell, be switched off. Its little flashes of information such as "FDX" and "WPRT" were annoying, as was the omnipresent underline. The line at the bottom is divided into eight discrete windows, each addressable through an escape sequence. I almost missed the feature entirely, as the manual gave very little indication of its presence and no examples. Furthermore, when I tried it, I found that the default display mode for the windows was half intensity. The contrast and brightness controls were set sufficiently low so that nothing appeared when I wrote to the areas. The worst part about this is that the windows are fixed in length, with required spaces between them. Why not give me 80 characters that I can divide up the way I see fit? I understand that the function keys are truly programmable, but since the feature was totally undocumented in the several pieces of documentation that I had, I didn't have a chance to test it. The terminal has a maximum specified speed of 9,600 baud; I found that it would communicate at 19,200 baud, but would drop characters at that speed.

The Zenith doesn't have a printer port. In addition to its VT-52 extension escape codes, it will also accept the ANSI standard escape sequences. (Whoever accepted them as a standard should be shot. They are unnecessarily long-winded and downright confusing.) By the way, the extensions to the DEC VT-52 sequences are different from those used by Visual. The 25th line on the Z19 doesn't display anything unless you put it there. It is implemented as a one-line terminal, with all the operating characteristics of its 24-line counterpart above it. The documentation is excellent, in keeping with Heath's longstanding reputation for detailed, well-illustrated examples. It comes with schematics, circuit descriptions, and realignment instructions. It also comes with a 10-foot RS-232 cable, the only terminal I know of below $1,000 to be so equipped. The hobbyists have been inside the Zenith for a long time, including the ROM listing, written in Z80 assembler and available from Heath. They found out that 19,200 baud had been built into the terminal, but that it couldn't keep up when processing things that took it longer, such as reverse video.

Summary

By now you have either discerned that none of the above products is perfect or have dismissed me as a hypercritical twit. The point of all this is that the features offered by the terminal manufacturers do not necessarily jibe with the needs of the typical user. Indeed, many of the "features" are downright obstacles. I could go down the list of features from these five manufacturers and put them together into a top-flight terminal:

The video quality of the Visual, the Wyse's case and split screen modes, the Zenith's 25th line, the Visual's keyboard and setup mode and a few additional items, such as a fully programmable keyboard (any key can generate any character or sequence of characters) with movable keytops, full intermix of all video modes or attributes and a manual that explained it all. What? No features from the ADDS or Televideo? Those are the breaks. Biggest is not always best in this business.

While I was writing this article, another author called me, wanting to make sure that I didn't have any false impressions of the Televideo 925, assuring me that he hated his, and for lots of good reasons. Others to whom I mentioned the article told me more horror stories than I can relate here, about some of these brands and some others. A picture emerged of products coming to market without sufficient testing, poor quality control, indifferent customer service, unknowledgeable technical support, and total lack of understanding of the microcomputer market. Another picture also emerged, one in which neophyte users have no idea of the potential offered by properly designed terminals and were either sold a bill of goods by unscrupulous dealers or, even more common, were victims of the blind leading the blind.

Of the terminals I reviewed here, the Zenith is a real workhorse, despite its limited features (do you really need a printer port?) and lack of "modern" ergonomic design. The Visual 50 is the most promising new terminal to come out so far, especially in light of its price. The Wyse has too many of the wrong kinds of features and the ADDS and Televideo don't, in my opinion, have much to offer anyone. This doesn't mean, however, that the dealers will drop their Televideo lines for Visuals. The reason is simple: profit. The dealer can make 30 percent or better selling the Televideo at list, while the Visual nets him less than 20 percent. The margins are similar to Televideo's on the ADDS, and everyone is discounting the Zenith so heavily that the dealer virtually can't sell it at list after the customer has read one or more ads in *Byte*. For an extra 10 percent, most dealers will turn a blind eye towards the qualitative differences among terminals.

The bottom line, then, is that while none of these terminals is perfect, there are clear choices to be made by the discriminating buyer. The manufacturers may not be listening closely enough, but there is a way to get their attention—with your wallet.

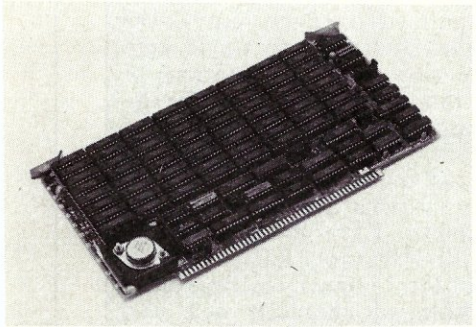
Although none of these terminals is perfect, there are still clear choices to be made by the discriminating buyer.

EXTRA EXTRA

S-100 World News

MACROTECH International Corporation 22133 Cohasset Street, Canoga Park, California 91303 • 213-887-5737

Megabyte S-100 Memory Here Now



Major breakthrough made by Macrotech International Corporation

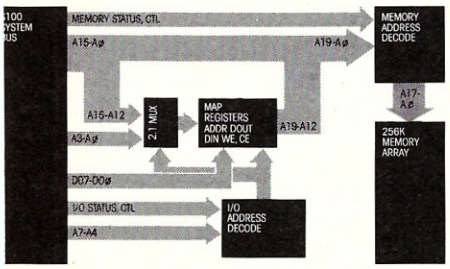
CANOGA PARK (MI)-January 20, 1983-Mike Pelkey, president of Macrotech International Corporation, today announced a major technological breakthrough in S-100 dynamic memory board density. A full megabyte of high speed dynamic ram is contained on a single standard size S-100 multilayer P.C. board. The product, dubbed 'Max' meets all IEEE/696 mechanical and electrical specifications and byte parity generation/checking is included as a standard feature. Max supports IEEE/696 24-bit addressing (selectable at any 128K boundary), 8/16 data transfer protocol, phantom line operation, and the same ultra low noise bus signal filtering provided on Macrotech's popular high performance 256K dynamic memory board.

Max is in production now and shipping at the all-time low cost per bit list price of $1,983 in unit quantity.

Bruce Kimmel, Macrotech's sales manager reports that customers are being served on a "first-in, first-out" basis and warns that due to a high incidence of graphics and similar memory-intensive applications, along with an unwillingness in the trade to pay exorbitant prices for memory, backlogs may occur for Max which could delay shipments against some late orders. With the improbability of second sourcing for some time, interested parties are urged to get orders in as soon as possible. Bruce can be contacted at 22133 Cohasset Street, Canoga Park, California 91303, or reached by telephone at (213) 887-5737.

M³ Family Growing

Another product recently introduced by Macrotech is soaring to the top of the best-seller list. The Multiuser II is a 128 kbyte 70ns CMOS static ram memory board that is unquestionably without peer in the S-100 marketplace. It's a 6-layer board with blazing speed, 8/16 data transfer protocol, and ultra-low power external battery support. The same M³ memory mapped addressing architecture so in demand with system software professionals is now standard in the new Multiuser II. M³ was first developed by Macrotech for the popular Multiuser I 256K dynamic ram board to meet the demanding requirements of today's sophisticated systems.

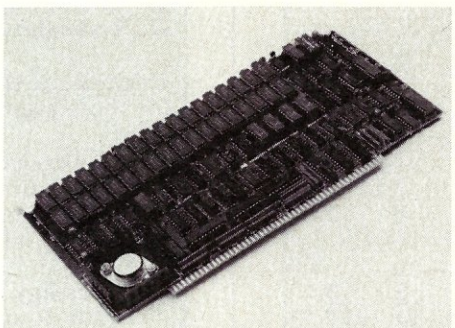


Macrotech's advanced memory mapping scheme allows each 4K block of the 16 bit (64K) logical addresses to be dynamically translated to any 4K block of the physical memory. Global memory can be configured to any size and located anywhere in the logical address space. All remaining memory can be addressed through the remaining logical address space by simply reloading the mapping registers to address the desired physical memory blocks. This scheme permits unlimited use of all on-board physical memory.

Virtual Disk Flexibility Cited

CANOGA PARK-January 20, 1983-Macrotech reports their Multiuser I and Multiuser II S-100 ram memory boards can be used as both system memory and "virtual disk" storage in eight or sixteen-bit applications. Addressing flexibility is the key. The Multiuser M³ memory mapped addressing is guaranteed to allow memory partitioning to fit the exact requirements of your system without ever wasting a single byte.

Today's trend in operating systems appears to include extended memory capabilities to allow for the recent technological advances in semiconductor memory. A close look at Digital Research's new CP/M 3™ for example, would lead you to believe that it was especially created to fit Macrotech's family of Multiuser memory boards. (It wasn't, but try to find one that fits better.)



Where it all started: pictured is the popular Multiuser I, Macrotech's first product. This widely used board provides 256 Kbytes of dynamic ram with 4K page memory mapping (called M³), 8/16 bit operation, 24 bit addressing and byte parity checking.

MACROTECH Announces Distribution Expansion

CANOGA PARK-January 20, 1983-Macrotech is now establishing domestic and international dealer/representative networks. The California based firm is expanding it's customer support through these channels and invites inquiries. Volume users and retailers should contact the company for details.

Macrotech's marketing director Bob Ryle states, "IEEE/696 has made S-100 legitimate. It is rapidly gaining acceptance due to its inherently superior speed characteristics." Ryle attributes the growing demand for Macrotech memories to Macrotech's strict adherence to the IEEE standard.

Applied Digital Data Systems, Inc.
100 Marcus Blvd.
Hauppauge, NY 11787
(516) 231-5400

Visual Technology, Inc.
540 Main St.
Tewksbury, MA 01876
(617) 851-5000

Televideo Systems, Inc.
1170 Morse Avenue
Sunnyvale, CA 94086
(408) 745-7760

Zenith Data Systems
1000 Milwaukee Ave.
Glenview, IL 60025
(312) 391-8862
(800) 323-5924

Wyse Technology
2184 Bering Drive
San Jose, CA 95131
(408) 946-3075

Below is my attempt to quantify the judgments made in the article. Many are subjective, since the objective criteria are not the ones that will determine whether you love or hate the terminal. The numbers range from a low of one to a high of five.

Feature Comparison Chart

Feature	ADDS 60	Visual 50	Tele-video 925	Z19	WY-100
Style	4	4	4	3	5
Overall Quality	2	5	3	4	3
Keyboard	3	5	2	4	2
Rollover/ false keying	5	5	3	4	4
Video Quality	1	5	4	4	3
No. of attributes	5	5	5	2	5
Attribute method	2	5	2	4	2
Suitability for micros	2/24	5/39	3/26	5/30	3/27
List Price	$895	695	995	895	995

Another way to skin the cat

Have you been looking for the perfect terminal and been unable to find it? Don't despair—find one that is microprocessor based, such as the Zenith or Visual (both are Z80 based) and reprogram it to do what you want.

This is precisely the solution adopted by several companies. Prodigy Systems, Inc. offers an enhanced Visual 200 terminal with all the function keys preprogrammed to reduce many of the WordStar's multikey functions to single keystrokes. There are also several adaptations of the Televideo 950 that accomplish the same objective, with varying degrees of success.

The most ambitious that I have seen is Extended Technology Systems' Super-19 enhancement for the Zenith Z19. A single 2732 EPROM adds a host of features, including variable scrolling area (2 to 25 lines), realtime clock and calendar, additional character sets and symbols, hardware handshaking, light pen support, DEC VT100 compatibility, optional interlaced video, and operation at up to 38,400 (!) baud. To borrow a phrase, the other features are "too numerous to mention" here. The documentation is a little sparse, but there is telephone support available. The best part about the Super-19 is its price: $49.95. That's a lot of functionality for the money.

It may be that the most significant feature of the Super-19 is its hardware handshaking, using the RTS and CTS lines. This, in conjunction with its "slow-transmit" mode of feeding escape sequences generated from the keyboard to the computer, virtually guarantees that characters will not be lost at either end. Have you ever seen a terminal run at 38,400 baud? Breathtaking! It eliminates the advantage of memory-mapped video in all but the most graphics-intensive applications. I feverently hope that terminal manufacturers will agree upon a hardware handshaking protocol for their products, and that computer manufacturers will get in sync with them, such as the emerging DTR standard for printers.

Once again, the little guys are pointing the way for the big guys. The Super-19 is super.

Extended Technology Systems
1121 Briarwood
Bensalem PA 19020
(215) 376-5043 or 752-4604

Prodigy Systems Inc.
501 Route 27
Iselin NJ 08830
(201) 283-0600

A Better MULTiply Algorithm

Increasing speed and flexibility

by John B. Robb

On page 8.11 of Lance Leventhal's *Z80 Assembly Language Programming* (published by Osborne/McGraw-Hill, Berkeley, CA) appears an 8-bit multiplication algorithm coded for the Z80. It is accompanied, on page 8.12, by the following notes on timing:

> *The algorithm takes between 390 and 400 cycles to multiply on a Z80 microprocessor. The precise time depends on the number of one bits in the multiplier. Other algorithms may be able to reduce the average execution time somewhat, but 400 clock cycles will still be a typical execution time for a software multiplication.*

The latter statement is further buttressed by a footnote referencing an impressive array of theoretical publications. A thumb of the nose to all us seat-of-the-pants bit grubbers out here!

The Leventhal algorithm goes like this (in Z80 code):

```
        LD      A,multiplier
        LD      B,#bits in multplier
        LD      DE,multiplicand
        LD      HL,0
MULT:
        ADD     HL,HL
        RLA
        JR      NC,CHCNT
        ADD     HL,DE
CHCNT:
        DJNZ    MULT
```

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The 8080 algorithm offered here is my response. First, here are a few points by way of comparative summary:

(1) My algorithm is significantly faster: 30-50% faster for the usual case, where at least one of the numbers to be multiplied is small.

(2) In the Leventhal algorithm the product register pair must be initialized to 0; in mine the product RP can be initialized to a base value to which the results of the multiplication are added—an important practical advantage.

(3) Both multiplier and multiplicand in the Leventhal algorithm are restricted to 8 bits; in mine the number of significant bits in multiplier and multiplicand together need only sum to 16. Thus at least one of the numbers to be multiplied (the multiplicand) can in most cases be larger than 255, depending on the number of significant bits required for the other (the multiplier).

(4) Although the Leventhal algorithm takes only 6 bytes, versus 11 for mine (when recoded for the Z80), its calling sequence requires 2 more to load the B register with the number of significant bytes in the multiplier. This is not only an unnecessary inconvenience, it actually squanders more memory when used as an out-of-line subroutine, rather than as an in-line macro.

I do not offer my algorithm as the ultimate 8-bit MULT. Indeed, since I am a relative neophyte to microprocessors and have so far encountered no other such algorithms, I would be very surprised if it were. Rather, I await the response of other readers and their improvements.

A Better MULTiply Algorithm continued . . .

```
;*****************************************************
;*                                                   *
;* MULT is an 8080 routine which returns  HL = HL + (A x DE)
;*                                                   *
;*   CALLING SEQUENCE:  MVI   A,multiplier           *
;*                      LXI   D,multiplicand         *
;*                      LXI   H,0 (or initial value of product)
;*                      CALL  MULT                   *
;*                                                   *
;*   SIDE EFFECTS: A=0; DE clobbered; BC preserved   *
;*                                                   *
;*     Note that the product is developed by ADDING TO the value
;*   in HL on entry; thus MULT might be used to calculate and add
;*   a variable offset to a fixed, pre-loaded base value.
;*                                                   *
;*     Note also that although MULT is basically an 8-bit multiply
;*   routine, the multiplicand must be loaded to register pair DE
;*   with high order zero bits cleared.  Actually, for maximum
;*   utility, MULT has been designed so it can handle multiplicands
;*   with more than 8 significant bits, provided the multiplicand
;*   and multiplier combined have no more than 16 significant bits.
;*                                                   *
;*                                        Bytes  Cycles
MULT:
        ANA     A       ;sets Z-flag & clears carry     1      4
        RZ              ;RET when done (maybe 1st time) 1     5/11
        RAR             ;shift m'plier 1 place right &  1      4
                        ;...set carry if bit is significant
        JNC     BUMPNXT ;skip the multiply if bit was 0 3     10
        DAD     D       ;MULTIPLY                       1     10
BUMPNXT:
        XCHG                                            1      4
        DAD     H       ;double m'pcand for next time   1     10
        XCHG                                            1      4
        JMP     MULT                                    3     10
;*                                                   *
;* EXECUTION TIME VALUES                             *
;*                                                   *
;*   Execution time depends on the number of significant bits
;* in the multiplier, and to a lesser extent on the ratio of
;* 1-bits to significant 0-bits.  Execution time in any particular
;* case can be calculated according to the formula:
;*                                                   *
;* Exec Time(cycles) = (#sig 1-bits * 61) + (#sig 0-bits * 51) + 15
;*                                                   *
;*   Thus with a multiplier of 50 (32h), the execution time would be
;* (3 * 61) + (2 * 51) + 15 = 300 cycles.  A smaller, perhaps more
;* typical multiplier, like 7, would take only 198 cycles.  The worst
;* case, with a multiplier of 255, would take 503 cycles.
;*                                                   *
;*   Oddly enough, there appears to be no way of improving on the
;* execution efficiency of this routine by rewriting it for the Z80.
;* And, even odder, it will actually run slightly faster on the 8080
;* as coded, due to the fact that the DADs take 11 cycles on the latter.
```

JJ

From CP/M 2 to CP/M Plus

Implementing a basic CP/M Plus system, step by step

by David Hardy and Ken Jackson

A P/M Plus, the next generation of the CP/M operating system, is finally available from Digital Research. Since the customized BIOS that most popular machines require is not yet available, this means that most end-users must now wait for their hardware manufacturer to implement CP/M Plus on their specific machines. This could take a long time, expecially if the machine is no longer supported by the manufacturer, or if the manufacturer gives a low priority to implementing CP/M Plus.

The obvious alternative to the (sometimes long) wait for manufacturer-provided software is to write it yourself. In the past, this would have been very difficult, especially given the less than great quality of the documentation provided with previous versions of CP/M. Fortunately, the documentation furnished with CP/M Plus is *much* better, and is relatively free of the "gotcha's" that were so common in the CP/M 1.x and 2.x manuals. In addition, if you currently have CP/M 2.2 running, the work is already more than half done.

The following is a basic step-by-step procedure for bringing up a simple (nonbanked) version of CP/M Plus on an existing CP/M 2.2 system, using the version 2.2 BIOS.

Modifying a CP/M 2.2 BIOS

The easiest way to make the transition from CP/M 2.2 to CP/M Plus is by modifying an existing 2.2 BIOS. By not including some of the more advanced (optional) features of CP/M Plus, a basic nonbanked system can be brought up in just a few hours (famous last words. . .). In general, the BIOS modifications required are:

1. Make your BIOS RMAC compatible.
2. Add the 16 new entry points to the jump vector.
3. Modify the BIOS CBOOT, GOCPM, and WBOOT routines to add functions to load the CCP.COM file and jump to it.
4. Expand the DPB and DPH data structures, and add the Directory Buffer Control Block.
5. Add the PUBLIC and EXTRN variables required by CP/M Plus.
6. Modify any existing routines that need to be changed because of any of the changes listed above.

Step 1. Make your BIOS RMAC compatible. Actually, your BIOS doesn't have to be assembled with RMAC, but it saves a lot of trouble, especially if you have to debug your system later. Also, all of the source files provided by Digital Research are RMAC compatible.

David Hardy, 736 Notre Dame, Grosse Pointe, MI 48230

Whatever assembler you use, it must be able to generate a .REL file that can be linked with Digital Research's link program. Since both RMAC and LINK are provided with CP/M Plus (along with the SID debugger and lots of other goodies), this is not an unreasonable requirement.

If you have any Z80 code in your BIOS, then just include a MACLIB Z80 instruction at the beginning of the file.

Step 2. Add the 16 new entry points to the jump vector. The CP/M Plus BIOS jump vector has been expanded from 17 jumps to 33. Of the 16 new jumps, only four actually have to be implemented in order to bring up a simple, nonbanked CP/M Plus system. The rest of the new jumps can just point to a RET instruction (see Listing 1).

Note that three of the four implemented new jumps (?DVTAB, ?DRTBL, and ?FLUSH) are simply used to return messages to the BDOS saying that the device table, drive table, and forced buffer flushing are not implemented.

The fourth new jump (?MOV) is to the MOVE routine, shown at the bottom of Listing 2 and Listing 6.

Note also that all of the jumps in the BIOS jump vector are defined as PUBLIC, so that the addresses are available during linking.

Step 3. Modify the BIOS CBOOT, GOCPM and WBOOT routines to add functions to load the CCP.COM file and jump to it. The routines shown in Listing 2 are typical CBOOT and WBOOT procedures. Note that the GOCPM label can usually be done away with, unless it is referenced somewhere in the BIOS. basically, the functions performed at the cold-start entry point (CBOOT) are:

1. Load the stack pointer (usually with 100H).
2. Print the sign-on message.
3. Initialize any internal BIOS pointers (like select "A" drive, etc.).
4. Initialize page 0.
5. Set the System Control Block pointers.
6. Jump to the warm-start entry point.

The functions performed at the warm-start entry point (WBOOT) are:

1. Load the stack pointer.
2. Set up the initial DMA address.
3. Load the CCP.COM file.
4. Initialize page 0.
5. Jump to address 100H (the CCP).

You'll also have to add the rest of the routines shown in Listing 1 to perform the initialization procedure and load the CCP.COM file. The routines OPEN, SETMULTI, REBOOT, and SETBUF are all use by the ?LDCCP routine to load the CCP.

Step 4. Expand the DPB and DPH data structures, and add the directory buffer control block. Two new bytes have been added to the end of the Disk Parameter Block (as shown in Listing 3). They are the Physical Shift Factor (PSH), and the Physical Record Mask (PHM). Because BIOS deblocking is to be used in this simple CP/M Plus implementation, both the PSH and the PHM bytes are set to zero to tell the BDOS that it is not supposed to perform any deblocking operations.

The Disk Parameter Headers (see Listing 4) also require modification to add several new flags and pointers. Three bytes are now reserved as a BDOS "scratch" area. Also, a media flag, directory and data buffer control blocks, and a hash table pointer and hash table bank number have been added. Because directory hashing is not used here, the hash table pointer has been set to 0FFFFH. Note that these additions to the DPH have placed the DPB address pointer in a new position relative to the start of the DPH. Note also that the old Directory Buffer Pointer has been eliminated with the addition of the Directory Buffer Control Block (DIRBCB).

CP/M Plus requires a directory buffer control block to locate physical record buffers for the BDOS. Therefore, a Directory Buffer Control Block must be added to the BIOS. Only one of these DIRBCBs is needed, regardless of how many drives are available to the system. The DIRBCB is shown in Listing 4. In a nonbanked system, it is 12 bytes long. The DRV byte must be set to 0FFH so that GENCPM will not automatically allocate buffers. Three additional bytes (not shown) are used in a banked version: the BANK byte, which contains the bank number of the BCB, and the LINK address of the BCB, which points to the next linked BCB.

Step 5. Add the PUBLIC and EXTRN variables required by CP/M Plus. This is an easy one. Include Listing 5 at the beginning of your BIOS so that all PUBLIC and EXTRN variables will be properly handled by RMAC. This is necessary because the CP/M Plus system is made by LINKing .REL files which reference variables between different files. For example, the BDOS references several variables that are defined in the SCB, etc.

Step 6. Modify any existing routines that need to be changed because of any of the changes listed above. This usually includes taking into account the expanded DPH and DPB tables. Also, because double-bit allocation vectors are used, the size of the allocation vectors (pointed to by ALV0-ALV1 in Listing 4) *must be doubled.* This is very important, and must be done to prevent CP/M Plus from possibly returning an inaccurate amount of free space for a drive.

Generally, the expanded DPBs and DPHs will require that some modifications be done in the BIOS's SETDRV routine, since SETDRV usually uses the DPB and DPH tables to determine density, number of sides, etc.

Making the loader BIOS from the BIOS

After you have made the BIOS, it is a simple matter to modify it for use as the Loader BIOS (LDRBIOS). The basic differences can be seen by comparing Listing 2 (BIOS CBOOT routines) with Listing 6 (LDRBIOS CBOOT routines). Notice that the ?INIT, ?LDCCP, and their supporting routines (SETMULTI, REBOOT, etc.) are not needed in the LDRBIOS. Note also that the CBOOT routine of the LDRBIOS does *not* load the stack pointer, and that the LDRBIOS' CBOOT routine RETurns, instead of jumping to address 100H like the BIOS' CBOOT routine.

Actually, much of the BIOS can be removed when making it into the LDRBIOS, but this can be done more safely *after* CP/M Plus is up and running.

Assembling and linking the BIOS to make CPMLDR.COM and BIOS3.SPR

The general procedure is:

1. RMAC BIOS
2. RMAC LDRBIOS
3. RMAC SCB
4. LINK BIOS3[B]=BIOS, SCB
5. GENCPM (see following section)
6. LINK CPMLDR [L100]=CPMLDR, LDRBIOS

Note that you must GENCPM before linking the CPMLDR. To save time and disk space, the "$PZ -S" options can be used with RMAC to suppress generation of a listing and a symbol file. Step 4 above will generate the file BIOS3.SPR, which is required by GENCPM to generate the file CPM3.SYS, which is the actual CP/M Plus system that is loaded and executed by CPMLDR. Step 6 above will generate a CPMLDR.COM file that can be executed under CP/M 2.2 to start up CP/M Plus.

Generating the CPM3.SYS system file

Once the BIOS.ASM and SCB.ASM files have been assembled and linked, the actual CP/M Plus system must be generated. This is done by executing the program GENCPM. The GENCPM dialog for the simple CP/M Plus implementation described here is shown on page 96.

Notice that if you answer a question by just typing a return, the default value (shown in parentheses) is used. The only answers that *must* be entered are "Top page of memory" and "Bank-switched memory." The top page of memory is, of course, whatever you choose it to be, and this implementation of CP/M Plus is nonbanked, so there is no bank-switched memory.

After GENCPM has been completed, CPMLDR should be linked (see step 6 of the previous section). After that, you should be able to execute CPMLDR.COM and see the sign-on message of CP/M Plus.

The documentation furnished with CP/M Plus is much improved, and if you have CP/M 2.2 the work is already half done.

GENCPM Dialog

```
A>GENCPM
CP/M 3.0 System Generation

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Default entries are shown in (parens).

Default base is Hex, precede entry with # for decimal

Create a new GENCPM.DAT file (N) ?

Display Load Map at Cold Boot (Y) ?

Number of console columns (#80) ?

Number of lines in console page (#24) ?

Backspace echoes erased character (N) ?

Rubout echoes erased character (Y) ?

Initial default drive (A:) ?

Top page of memory (FF) ? F7

Bank switched memory (Y) ? N

Double allocation vectors (Y) ?

Accept new system definition (Y) ?

BIOS3    SPR   E900H   0F00H

BDOS3    SPR   CA00H   1F00H

*** CP/M 3.0 SYSTEM GENERATION DONE ***

A>
```

Debugging tips

Naturally, nothing new works the first time. You will probably have to debug your BIOS and LDRBIOS. Any bug you find in one will almost certainly be in the other. Digital Research has made debugging a bit easier by providing the SID debugger with CP/M Plus. In addition, there is a command-line switch in the CPMLDR program that will break (return to the SID debugger) after loading the CPM3.SYS file into memory. The procedure for using this switch is outlined in Section 6 of the CP/M Plus System Guide. Using this switch, you can quickly determine if the problems are in your LDRBIOS or your BIOS.

Something else to watch out for might be some irregularity in the original 17 jumps of your BIOS' jump vector. The requirements are outlined in the appendix "Modifying a CP/M 2 BIOS" in the CP/M Plus System Guide.

The most common implementation problems are caused by malfunctions in the SETDRV section of the BIOS, often where a DPB or DPH is accessed. The expanded DPBs and DPHs of CP/M Plus must be taken into account when calculating into these tables.

If you make any changes in the BIOS or LDRBIOS, be sure to completely rebuild the CP/M Plus system. You should relink the CPMLDR whenever you change the BIOS or CPM3.SYS file.

Some final words

Although this is an incomplete implementation of CP/M Plus, it is enough to "bring up" the CP/M Plus system, to allow expansion, and to let you get familiar with the operation of CP/M Plus. Eventually, BDOS deblocking may be included to reduce the size of the BIOS, and banked memory may be added. The time functions, device table, and drive table are also not used here, but can be easily added, once the basic system is running.

```
*****************************************************************
                         LISTING 1
                THE CP/M PLUS JUMP VECTOR

;
;   BIOS Jump Vector
?BOOT:  JMP     CBOOT                   ; cold start entry point
WBOOTE:
?WBOOT: JMP     WBOOT                   ; warm start entry point
?CONST: JMP     CONST                   ; console status
?CONIN: JMP     CONIN                   ; console input
COUT:
?CONO:  JMP     CONOUT                  ; console output
?LIST:  JMP     LIST                    ; list device
?AUXO:  JMP     PUNCH                   ; punch device
?AUXI:  JMP     READER                  ; reader device
?HOME   JMP     HOME                    ; seek home track
?SLDSK: JMP     SETDRV                  ; select disk
?STTRK: JMP     SETTRK                  ; seek track
?STSEC: JMP     SETSEC                  ; set sector
?STDMA: JMP     SETDMA                  ; set dma
?READ:  JMP     READ                    ; read sector
?WRITE: JMP     WRITE                   ; write sector
?LISTS: JMP     LISTST                  ; return list status
?SCTRN: JMP     SECTRAN                 ; sector translate
;
;   New CP/M Plus jumps
?CONOS: JMP     CONOST                  ; Return Output Status of Console
?AUXIS: JMP     AUXIST                  ; Return Input Status of Aux. Port
?AUXOS: JMP     AUXOST                  ; Return Output Status of Aux. Port
?DVTAB: JMP     DEVTBL                  ; Return Address of Char. I/O Table
?DEVIN: JMP     DEVINI                  ; Initialize Char. I/O Devices
?DRTBL: JMP     DRVTBL                  ; Return Address of Disk Drive Table
?MLTIO: JMP     MULTIO                  ; Set number of logically consecutive
                                        ;  sectors to be read or written
?FLUSH: JMP     FLUSH                   ; Force Physical Buffer Flushing for
                                        ;  user-supported deblocking
?MOV:   JMP     MOVE                    ; Memory Move for Large Memory Copy
?TIM:   JMP     ?TIME                   ; Get The Time
?BNKSL: JMP     SELMEM                  ; Select Alternate Bank of Memory
?STBNK: JMP     SETBNK                  ; Select Bank for DMA Operation
?XMOV:  JMP     XMOVE                   ; Set Bank When a Buffer is in a Bank
                                        ;  other than Ø or 1
        JMP     USERF                   ; Reserved for System implementor
        JMP     RESERV1                 ; Reserved for future use
        JMP     RESERV2                 ; Reserved for future use
;
;   Device Table not implemented, so reutrn with HL=Ø
DEVTBL: LXI     H,Ø
        RET
;
;   Force Buffer Flush not implemented, so return A=Ø, Z=1
FLUSH:  XRA     A
        RET
;

;   Drive Table not implemented, so return HL=ØFFFEH
DRVTBL: LXI     H,ØFFFEH        ;DRVTAB
        RET
;
;   These routines are not implemented, so all just RET
CONOST:
AUXIST:
AUXOST:
DEVINI:
MULTIO:
XMOVE:
SELMEM:
SETBNK:
USERF:
RESERV1:
RESERV2:
?TIME:
        RET
;
```

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From CP/M 2 to CP/M Plus continued . . .

This installation technique has been used successfully to implement CP/M Plus on a Morrow Designs DJ2D board, an Advanced Digital Super Quad board, and a Sierra Data Systems SBC-100, and a Digital Group system. All of the examples used here are from the DJ2D BIOS, because it is the most representative of a typical CP/M machine. Space does not allow the entire DJ2D BIOS to be listed here (it's 38K long!), but it is available on several RCP/M systems around the country, and also on CompuServe's CPMIG CP/M bulletin board.

```
*****************************************************************
                        LISTING 2
                   BIOS BOOT ROUTINES

;
CBOOT:  LXI     SP,TPA          ;Set up stack
        LXI     H,PROMPT
        CALL    MESSAGE         ;Send the DJ2D sign-on message
        XRA     A               ;Select disk A internally
        STA     CPMDRV
        STA     CDISK
        CALL    ?INIT           ;Initialize page zero and SCB pointers
;
WBOOT:  LXI     SP,TPA          ;Set up stack
GOCPM:  LXI     H,BUFF          ;Set up initial DMA address
        CALL    SETDMA
        CALL    ?LDCCP          ;Load the CCP.COM file
        MVI     A,JMP           ;Initialize page zero
        STA     0
        STA     5
        LXI     H,WBOOTE
        SHLD    1
        LHLD    @MXTPA
        SHLD    6
        LDA     CDISK
        MOV     C,A
        JMP     0100H           ;Jump to the CCP.COM file
;
;  Subroutine to initialize page zero and SCB pointers
?INIT:  MVI     A,JMP           ;Set up jumps at 0 and 5
        STA     0
        STA     5
        LXI     H,WBOOTE
        SHLD    1
        LHLD    @MXTPA
        SHLD    6
        LXI     H,1
        SHLD    @CIVEC          ;Set up SCB
        SHLD    @COVEC
        LXI     H,2
        SHLD    @LOVEC
        LXI     H,4
        SHLD    @AIVEC
        SHLD    @AOVEC
        LXI     H,LOG$MSG       ;Print the CP/M 3 sign-on message
        CALL    MESSAGE
        RET
;
;  Subroutine to load the CCP.COM file
?LDCCP: XRA     A
        STA     CCP$FCB+15      ;Zero extent
        LXI     H,0
        SHLD    FCB$NR          ;Start at beginning
        LXI     D,CCP$FCB
        CALL    OPEN            ;Open CCP.COM file
        INR     A
        JZ      NO$CCP          ;Error if no file
        LXI     D,0100H
        CALL    SETBUF          ;Set start of TPA
        LXI     D,128
        CALL    SETMULTI        ;Allow up to 16k bytes
        LXI     D,CCP$FCB
        CALL    REBOOT          ;Read CCP.COM into memory
        RET
;
;  Report error if CCP.COM not found, and loop
NO$CCP: LXI     H,CCP$MSG
        CALL    MESSAGE         ;Report missing CCP/COM file
        CALL    ?CONIN          ;Wait for a keystroke
        JMP     ?LDCCP          ;then try again
;
;  CP/M BDOS FUNCTION INTERFACE FOR ?LDCCP
OPEN:   MVI     C,15
        JMP     BDOSGO          ;Open file control
;
SETMULTI:
        MVI     C,44
        JMP     BDOSGO          ;Set Mulit-Record count
;
REBOOT: MVI     C,20
        JMP     BDOSGO          ;Read records
;
SETBUF: MVI     C,26
        JMP     BDOSGO          ;Set DMA address
;
BDOSGO: LHLD    @MXTPA          ;Find BDOS address and jump to it
        PCHL
;
;  CP/M 3.0 sign-on message
LOG$MSG:
        DB      13,10,13,10,'CP/M Version 3.0',00
;
;  MISSING CCP.COM error message
CCP$MSG:
        DB      13,10,'BIOS Err on A: NO CCP.COM file',00
;
;  File Control Block for CCP.COM file
CCP$FCB:
        DB      1,'CCP     ','COM',0,0,0,0
        DS      16
FCB$NR: DB      0,0,0
;
;  Memory move routine (referenced by BIOS jump vector)
MOVE:   LDAX    D
        MOV     M,A
        INX     D
        INX     H
        DCR     C
        JNZ     MOVE
        MOV     A,B
        ORA     C
        RZ
        DCR     B
        JMP     MOVE
;
*****************************************************************
                        LISTING 3
                 DISK PARAMETER BLOCK

;
dpb128s dw      26              ;SPT  CP/M sectors/track
        db      3               ;BSH  Block Shift Factor
        db      7               ;BLM  Block Mask
        db      0               ;EXM  Extent Mask
        dw      242             ;DSM  Number of Blocks - 1
        dw      63              ;DRM  Number of Directory Entries - 1
        db      0c0h            ;AL0  Initial Allocation Vector
        db      0               ;AL1
        dw      16              ;CKS  Size of Directory Check Vector
        dw      2               ;OFF  Number of Reserved Tracks
        DB      00              ;PSH  (NEW) Physical Record Shift Factor
        DB      00              ;PHM  (NEW) Physical Record Mask
;

*****************************************************************
                        LISTING 4
        A DISK PARAMETER HEADER AND THE DIRECTORY BUFFER CONTROL BLOCK
;  DPH for Drive 0
DPZERO  DW      0               ;XLT  Address of translation table
        DW      0,0,0,0         ;72-bit BDOS scratch area
        DB      0
        DB      0               ;MF  Media Flag
        DW      0               ;DPB  Address of DPB
        DW      csv0            ;CSV  Directory check vector
        DW      alv0            ;ALV  Allocation vector
        DW      DIRBCB          ;DIRBCB  Directory BCB address
        DW      DATBCB          ;DATBCB  Data BCB address
        DW      0FFFFH          ;HASH  Directory Hashing Table address
        DB      0               ;HBANK  Bank Number of Hash Table
```

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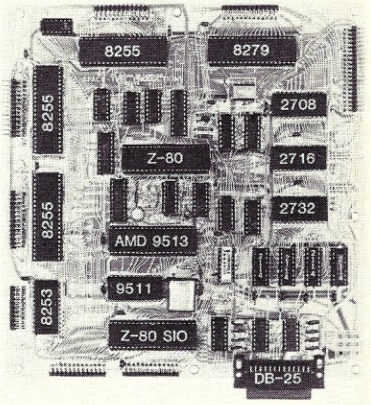

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From CP/M 2 to CP/M Plus continued. . .

```
;  DPH for Drive 1
DPONE   DW      0               ;XLT  Address of translation table
        DW      0,0,0,0         ;-0-  (NEW) 72-bit BDOS scratch area
        DB      0
        DB      0               ;MF   (NEW) Media Flag
        DW      0               ;DPB  Address of DPB
        DW      csv0            ;CSV  Directory check vector
        DW      alv0            ;ALV  Allocation vector
        DW      DIRBCB          ;DIRBCB  (NEW) Directory BCB address
        DW      DATBCB          ;DATBCB  (NEW) Data BCB address
        DW      0FFFFH          ;HASH  (NEW) Directory Hashing Table address
        DB      0               ;HBANK  (NEW) Bank Number of Hash Table
;
;  Directory Buffer Control Block
DIRBCB: DB      0FFH            ;DRV  Drive with record in BUFFAD
        DB      00,00,00        ;REC#  Record position of contents of BUFFAD
        DB      00              ;WFLG  Buffer written flag
        DB      00              ;00  BDOS scratch byte
        DW      0000            ;TRACK  Physical track of buffer contents
        DW      0000            ;SECTOR  Physical sector of buffer contents
        DW      DIRBUF          ;BUFFAD  Address of BCB buffer


*****************************************************************
                         LISTING 5
                PUBLIC AND EXTERNAL VARIABLES


        PUBLIC  ?BOOT,?WBOOT,?CONST,?CONIN,?CONO,?LIST,?AUXO,?AUXI
        PUBLIC  ?HOME,?SLDSK,?STTRK,?STSEC,?STDMA,?READ,?WRITE
        PUBLIC  ?LISTS,?SCTRN
        PUBLIC  ?CONOS,?AUXIS,?AUXOS,?DVTAB,?DEVIN,?DRTBL,?MLTIO,?FLUSH
        PUBLIC  ?MOV,?TIM,?BNKSL,?STBNK,?XMOV
        PUBLIC  ?INIT,?LDCCP
        EXTRN   @CIVEC,@COVEC,@AIVEC,@AOVEC,@LOVEC,@MXTPA


*****************************************************************
                         LISTING 6
                  LOADER BIOS BOOT ROUTINES
;
CBOOT:  CALL    TINIT           ;Initialize the terminal
        LXI     H,PROMPT
        CALL    MESSAGE         ;Send the DJ2D sign-on message
        XRA     A               ;Select disk A internally
        STA     CPMDRV
        STA     CDISK
;
wboot:
GOCPM:  LXI     H,BUFF          ;Set up initial DMA address
        CALL    SETDMA
        MVI     A,JMP           ;Initialize page zero
        STA     0
        STA     5
        LXI     H,WBOOTE
        SHLD    1
        LDA     CDISK
        MOV     C,A
        RET                     ;Return
;
;  Memory move routine (referenced by BIOS jump vector)
MOVE:   LDAX    D
        MOV     M,A
        INX     D
        INX     H
        DCR     C
        JNZ     MOVE
        MOV     A,B
        ORA     C
        RZ
        DCR     B
        JMP     MOVE
;
```

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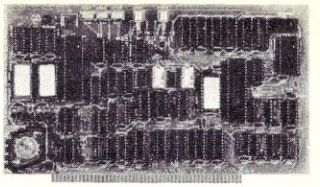

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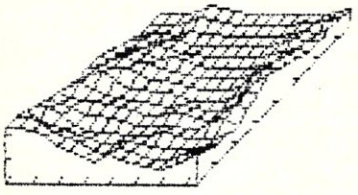

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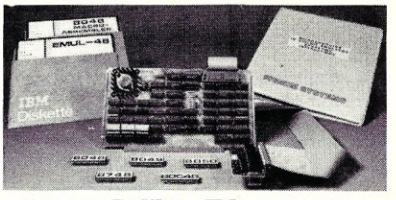
CIRCLE 192 ON READER SERVICE CARD



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- IEEE-696 (S-100), CP/M compatible
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Emulator comes on one S-100 board with a 3 ft. cable and buffer assy. that plugs into the user's uP socket. The board with all supporting software is $995. For 8048 MACRO Assembler add $150.

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Software Information Center

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.....C/UNIX BESTSELLERS.....

The C language and UNIX operating system are becoming standards in the world of new 16-bit micrcocomputers. Key books are:

- ☐ C Programming Language, $19.50 postpaid
- ☐ Primer to C, $16.50 postpaid
- ☐ C Puzzle Book, $14.50 postpaid
- ☐ Using the UNIX System, $20.50 postpaid
- ☐ C/UNIX Market News, quarterly commercial news, interviews & note, $12 a year

.....APL BESTSELLERS.....

APL's high-level operations make it a popular language among programming end-users.

- ☐ APL: An Interactive Approach, $23.50 postpaid
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- ☐ APL Micro Report, $26.00 postpaid
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- ☐ Application Dev. W/o Programmers, $34.00
- ☐ APL Market News, quarterly commercial news, interviews & notes, $12 a year
- ☐ All 1980-1981 APL Market News back issues (seven total), $21.00 postpaid
- ☐ APL interpreters for the IBM Personal Computer (software, call for quote)

.....MODULA-2 BESTSELLER.....

Modula-2's premiere work is by N. Wirth, creator of both Pascal and Modula-2:

- ☐ Modula-2 (Wirth), $15.00 postpaid

..... PASCAL BESTSELLERS.....

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- ☐ Pascal User Manual & Report, $11.00 pp
- ☐ Pascal Primer (Waite), $18.50 postpaid
- ☐ Pascal Handbook (Tiberghien), $21.50 pp
- ☐ Elementary pascal, $12.50 postpaid
- ☐ Beginner's Guide to the UCSD Pascal System (Bowles), $13.50 postpaid
- ☐ UCSD Pascal Handbook, $17.50 postpaid
- ☐ Apple-Pascal, $18.50 postpaid
- ☐ Apple-Pascal Games, $16.50 postpaid
- ☐ Practical Pascal Programs, $17.50 pp
- ☐ Pascal Market News, quarterly coverage of Pascal, Ada, Modula-2, $12 a year

.....ADA BESTSELLERS.....

Ada, derived from ALGOL and Pascal, and pushed by the DoD, looms as a significant new language. A Byte Magazine column especially recommends the first listing:

- ☐ Ada Programming Language, $19.50
- ☐ Studies in Ada Style, $11.50 postpaid
- ☐ Programming Embedded Systems w/Ada, $18.50
- ☐ Towards a Formal Desc. of Ada, $30.50 pp
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If not satisfied, money back upon return of resaleable merchandise within 15 days.

CIRCLE 210 ON READER SERVICE CARD

C SCREEN EDITOR

CSE: A full-screen text editor written in C

- Powerful command set includes cursor control, find/replace, block move, file inclusion, and nested macro commands
- Installation program allows easy customization for most popular terminals
- Available for CP/M-86[1], MP/M-86[1], CP/M 2.2[1], MS-DOS[2], and IBM PC[3]
- Requires 64K CP/M-86 or equivalent MP/M-86; 56K CP/M 2.2; 64K MS-DOS; 64K IBM PC
- Includes object code, C source code, and manual
- Available in 8" SSSD format for CP/M-86, MP/M-86, CP/M 2.2, MS-DOS
- **$60.00,** including UPS; additional versions $20.00 each

8080 SIMULATOR

SIM80: An 8080 simulator for the 8086/8088

- Run CP/M object code (.COM files) on any CP/M-86 or MP/M-86 system : ASM, DDT, dBase II[4], C/80, MBASIC, etc.
- Retain applications software when upgrading from CP/M to CP/M-86
- Develop and debug CP/M software on CP/M-86
- 8K overhead, TPA can be 61K
- 1/3 to 1/10 as fast as a 5 Mhz 8085 (**not recommended** for highly interactive programs such as Wordstar[5], or for very large, slow interpreted BASIC programs)
- Includes object code, ASM-86 source code, and manual
- Available in 8" SSSD format for CP/M-86, MP/M-86
- **$50.00,** including UPS

Both CSE and SIM80 for $90.00

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[1]tm, Digital Research; [2]tm, Microsoft; [3]tm, IBM; [4]tm, Ashton-Tate; [5]tm, Micropro

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Two CP/M Enhancements

by Robert J. Lurie and Kelly Smith

KEEPCCP: A Short Program to Prevent Overwriting the CCP

KEEPCCP protects CP/M's console command processor from being overwritten by a transient program.

To use it, type KEEPCCP and then, after the prompt reappears, type the name of the program. For example:

A>KEEPCCP
A>PROGNAME

The price of the protection afforded by KEEPCCP is the temporary loss of slightly more than 2 kilobytes of transient program area. The first warm boot following the execution of KEEPCCP unprotects CCP and restores the system.

```
org     100h
lhld    6       ;get the address of BDOS
push    h       ;save it
lxi     d,-809h ;fill locations 6-7 with a fake
dad     d       ; BDOS address that is 3 bytes
shld    6       ; below the start of CCP
pop     d       ;put a jump to the real BDOS at
mvi     m,jmp   ; the fake BDOS address
inx     h
mov     m,e
inx     h
mov     m,d
ret             ;return to CCP
end
```

Robert J. Lurie, 8 Tingley Rd., Morristown, NJ 07960

KEEPCCP permits using DDT or SID, two programs that normally overwrite CCP, to explore the workings of CCP. It also guarantees the availability of CCP for system-level commands issued from transient programs. Alternatively, it provides a convenient way to reserve 2K of memory for machine-language subroutines.

A Simple Subroutine to Check for "Stack Overflow"

Here is a simple subroutine to be CALLed in your applications program to check for a possible "stack overflow" condition. This subroutine might be especially helpful during the "debug stage" of your software where you may not be sure of your total stack requirements . . . you could make CALLs to "check$stack" from numerous places in your software as a monitor of stack allocation, and by using conditional assemblies, REMOVE all the CALLs when your debug is completed. Other applications, include stack-oriented languages such as STOIC, FORTH, or PASCAL, where some heavily "compute bound" applications programs could eventually "gobble up" memory and clobber the operating system.

I wrote a simple test program which you can use to verify the operation of "Check$stack". The exit on "blow up" resets the stack pointer to the "old

Kelly Smith, 3055 Waco St., Simi Valley, CA 93063

Check$Stack Listing

```
;
; This is the test for "check$stack"...with 'debug' false,
; the program will exit to CP/M with the stack overflow
; message.
;
true    equ     -1      ; define true
false   equ     not true; define false
debug   equ     false   ; define debug (if true, makes sufficient stack)
;
        org     100h
;
        lxi     h,0     ; save "old" CP/M stack pointer
        dad     sp
        shld    oldstk
        lxi     sp,stack; set "local" stack
        call    test
        lhld    oldstk
        sphl
        ret
;
test:   call    test1
        call    check$stack
test1:  call    test2
        call    check$stack
test2:  call    test3
        call    check$stack
        ret
test3:  ret
;
; end of test on "check$stack", incorporate the following code
; for your particular application...with a little more thought,
; you could also display the address of the last CALL prior to
; the "stack overflow", and thereby let your program tell you
; WHERE it BLEW UP...I will leave that exercise for you.
;
check$stack:            ; check to see if stack pointer is below STACK$END
;
        push    h       ; save H$L Regs.
        lxi     h,-stack$end    ; won't work for STACK$END = 0000
        dad     sp
        pop     h       ; restore H$L Regs.
        rc              ; return if still o.k.
;
; come here on stack over-flow
;
        lxi     h,0     ; clear H&L Regs.
        dad     sp      ; stack pointer to H&L Regs.
        lxi     d,stack ; get original stack top address
        mov     a,e     ; do 16 bit subtract, to calculate "stack depth"
        sub     l
        mov     e,a
        mov     a,d
        sbb     h
        mov     d,a     ; 16 bit result in D&E Regs.
        lhld    oldstk  ; restore "old" CP/M stack pointer
```

stack" pointer, then displays "Stack Over-Flow, Depth = nn" (where nn equals the "stack depth" in hexadecimal for up to 256 stack "levels"). Remember that the stack works *down* towards (typically) your applications program. Leave sufficient code between the "stack$end" and "oldstk" so that (at worst) you can exit on stack overflow "gracefully." You clobber "oldstk", and all bets are off.

Reprinted from **CP/M Net News.**

```
        sphl    d               ; save "stack depth"
        push    d
        lxi     d,stack$overflow$message
        mvi     c,9             ; display string function
        call    5               ; let CP/M do the work...
        pop     d               ; recover "stack depth"
;
display$stack$depth:            ; display up to 256 deep stack digits
;
        mvi     c,2             ; display 2 digits
        push b ! push d         ; save 2 digit count and "stack depth"
        mov     a,e             ; get hexadecimal digit
        rar ! rar ! rar ! rar   ; display high nibble first...
;
hexascii:                       ; convert 1 digit hexadecimal to 1 digit ASCII
;
        ani     0fh             ; mask for low nibble position
        adi     90h             ; convert hex digit to ASCII digit
        daa
        aci     40h
        daa
        mov     e,a             ; pass to CP/M in E reg.
        mvi     c,2             ; display character function
        call    5               ; let CP/M do the work...
        pop d ! pop b           ; get "stack depth" and digit count
        dcr     c               ; debump digit count
        rz                      ; return to CP/M, if both digits displayed
        push b ! push d         ; not yet, so display second digit
        mov     a,e             ; get hexadecimal digit
        jmp     hexascii; display and exit to CP/M, next time thru...
;
stack$overflow$message: ; indicate stack overflow
;
        db      0dh,0ah,'Stack Over-Flow, Depth = $'
;
oldstk: ds      2       ; storage for "old" CP/M stack pointer
;
        ds      32      ; "dummy" program storage
;
stack$end       equ     $       ; stack end
;
        if      debug   ; if debug,
        ds      32      ; 16 level stack
        else            ; else,
        ds      2       ; 1 level stack
        endif
;
stack   equ     $       ; stack starts here
;
        end
```

Five to Eight and Back Again

A method for transferring CP/M files from one disk system to another

by Ed Scott

Here is a way you can transfer languages, programs and data files from 5¼" disks to 8" disks. There are several reasons for wanting to transfer CP/M disk files from one disk system to another. These include switching from minidisks to standard 8" drives, and obtaining software that is not available for your CP/M disk system.

I encountered the transfer problem when I switched from Micropolis 5¼" to 8" disks, using the Tarbell double-density controller. I considered transferring everything to cassette tapes and then back to the new disk system. Another possible method would have been to use a modem and transfer between two computers. Thinking that there must be an easier way to accomplish the transfer, I figured out the following method. I know that it works to go from Micropolis Mod II to Tarbell double density and back again. It should also work for other combinations of disk systems, but may require some modification. I will describe the transfer for Micropolis to Tarbell. You will have to work out the details for different systems for on your own.

The solution is really very simple. First you need to get CP/M configured for both disk systems. You will need to configure each system to a different size so that they may coexist in memory without overlapping each other. I use a 48K Tarbel CP/M system and a 58K Micropolis CP/M system (see Figure 1). Next you need to put both the Tarbell and Micropolis controller cards into your motherboard. On my system, the 8" disk boots on reset and the Micropolis disk boots when I jump into its boot routine in ROM. The secret of jumping between the two systems is to change the warm boot address at location 0000H to the address of the system you want to jump into. DDT allows you to pull in disk files under one system, change the warm boot address, execute a warm boot into the other system and save the file on it.

Now let me describe the technique in detail for transferring a file from 58K Micropolis CP/M to 48K Tarbell CP/M:

1 Reset the computer and boot up the 48K Tarbell CP/M.
2. Run DDT (DDT<cr>). Examine the warm boot address at location 0002H using the D command. Make a note of this number (0BAH in this case).
3. Use the G command to jump into the Micropolis boot routine (GEC00<cr> in my case).
4. Run DDT (DDT<cr>). Examine the warm boot address at location 0002H using the D command. Make a note of this number also (0DCH in this case).
5. Return to Micropolis CP/M and use STAT to determine the number of records used by the file you want to transfer (STAT FILENAME.EXT<cr>). Make a note of this also.

Ed Scott, 1843 Lake Street, Glendale, CA 91202

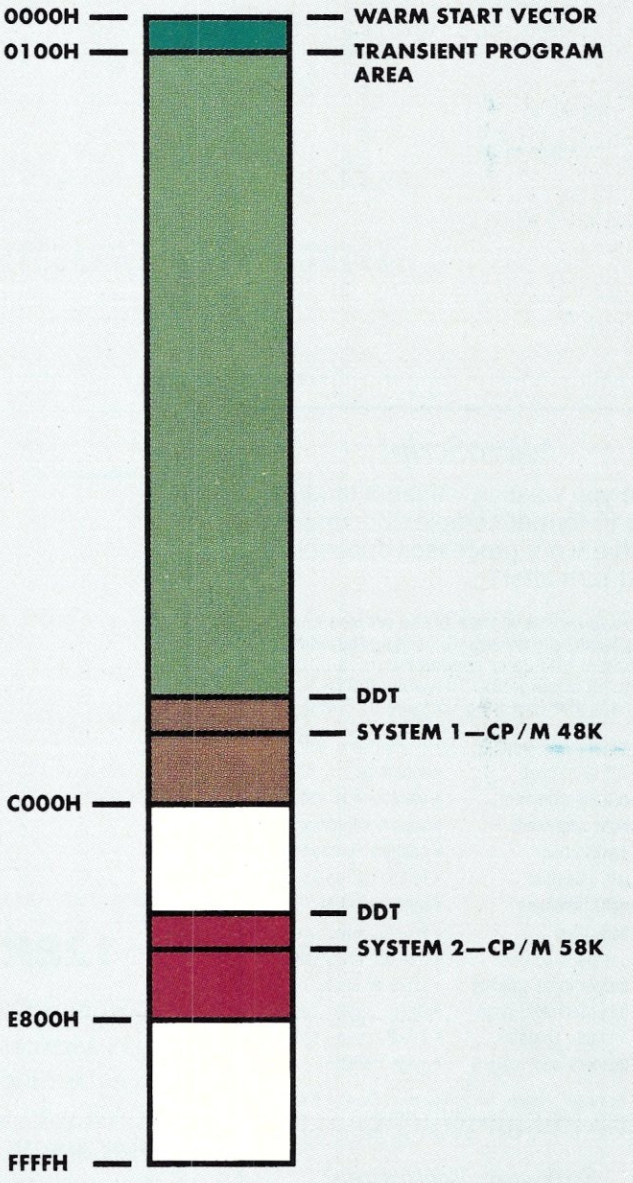


Figure 1. A memory map for the file transfer method described in the text.

6. Use DDT to pull in the file to be transferred.
7. Use the S command to change the warm boot address at location 0002H for the other system (BA in this case).
8. Execute a warm boot by jumping to 0000H (J0<cr>). This will transfer you into the other CP/M system.
9. Use SAVE to write the file to disk (SAVE n FILENAME.EXT<cr>).

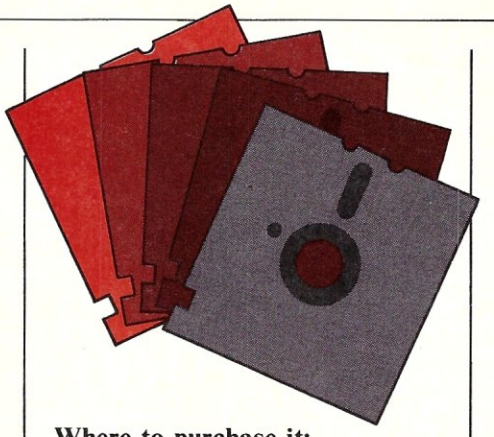
The number (n) of records to save can be determined from the number you found earlier using STAT. Going from Micropolis to Tarbell, I divide the number of records required on Micropolis disk by two (rounding up to the next largest integer, when necessary) and use this number as the number of double-density records to save. Using other systems may require appropriate modifications.

There is one problem you may encounter. Some files may be large enough that they exceed the TPA of the 48K CP/M system (i.e., they wipe out the 48K CP/M system). You may need to break these into smaller blocks using DDT and then transfer them. They can be recombined using PIP. Remember that you must use the [O] parameter to PIP together COM files.

The same method can be used in reverse to transfer from 8" to 5¼" disks. I have transferred the files on about 80 Micropolis Mod II disks across to Tarbell 8" double-density disks without losing a byte. It was time-consuming to transfer so many files, but not nearly as bad as the other methods mentioned would have been.

Software Directory

Program name: GRAPH for Diablo with Hyplot
Hardware system: 8080/Z80 CPU, CP/M, 8″ SSSD drive
Minimum memory size: 32K
Language: Object code
Description: Does data plots on Diablo printers/terminals (630, 1640, 1650) equipped with Hyplot option. User-friendly interface prompts for input of only: 1) lengths and labels of *x* and *y* axes, 2) number of different plots on graph, 3) name of raw data set (containing ASCII data in free-field format), 4) plot characters and precision. GRAPH reads and scales the raw data; it uses the Hyplot option to connect the points of a data plot at selected plot precisions of up to $1/120$″ in *x*-direction and $1/48$″ in *y*-direction. Input instructions are stored for easy modification later.
Price: $55
Included with price: Manual, SSSD 8″ disk



Where to purchase it:
Maurizi Associates
1344 Fitch Way
Sacramento, CA 95825
(916) 486-2993
CIRCLE 237 ON READER SERVICE CARD

Program name: INTRCEPT
Hardware system: Z80 running CP/M 2.2
Minimum memory: Any memory size supported by CP/M 2.2
Language: Z80 object code

Description: INTRCEPT is an on-line system utility that intercepts and processes CP/M-incompatible system calls originating from user programs running under CP/M 2.2. It automatically inserts a Call Handler (for call interception) and a Call Processor below the CP/M BDOS, and then loads and executes the user program. The current configuration of the Call Processor supports Cromemco CDOS system calls 0 to 27, plus several additional calls sufficient to handle most CDOS 1.xx-2.xx programs.

There are two versions of INTRCEPT: Version I with the Call Handler, Call Processor, and program loader in a single .COM file; and Version II with the Call Handler and program loader in a .COM file that automatically loads a separate Call Processor file. Version II is designed for user customization and is delivered with

both object code and fully documented source code for custom Call Processor design. Both INTRCEPT versions are transparent to user programs, perform full command line processing for the CP/M Default File Control Blocks and Command Line Buffer, and automatically adjust to any size CP/M environment from 20K to 64K.
When released: September 1982
Price: Version I, $89.95; Version II, $149.95
Included with price: 8" SSSD diskette, manuals, source code file for Version II.
Where to purchase it:
PRO microSystems
16609 Sagewood Lane
Poway, CA 92064
(619) 578-1240
CIRCLE 238 ON READER SERVICE CARD

Program name: Personal Finance Utility
Hardware system: Z80 CP/M system
Minimum memory: 32K
Language: Assembler and CB-80
Description: A fully integrated menu-driven set of subsystems to cover the financial needs of the microcomputer owner. Systems included are Personal A/R, Personal A/P, Personal Inventory and Net Worth, Mailing List/Label, Personal Appointments, and a set of utilities to handle miscellaneous functions such as disk cataloging, producing amortization schedules, etc.
Release: November 1982.
Price: $99.95
What is included: Program diskette with documentation.
Where to purchase it:
First Release Software
5814 Jester Drive
Garland, TX 75042
(214) 495-1323
CIRCLE 239 ON READER SERVICE CARD

Program name: VersaForm
Hardware system: IBM PC, double-sided diskettes
Minimum memory: 128K
Language: Pascal. Runtime p-system included with product.
Description: VersaForm allows a nonprogrammer to use his business forms to set up a microcomputer database, to selectively retrieve and update forms, and to print them out on preprinted forms. Supports hierarchically organized forms (invoices, purchase orders, student records, etc.). Automatic filling, data entry checking and calculation options may be chosen. A management reporting system produces sorted, detail, or summary reports of any data items contained in the file of forms.
Release: September 3, 1982
Price: $389; includes full documentation, tutorial disk.
Where to purchase it: Through dealers or from:
AST
14125 Capri Drive - Ste. #4
Los Gatos, CA 95030
(408) 370-2662
CIRCLE 240 ON READER SERVICE CARD

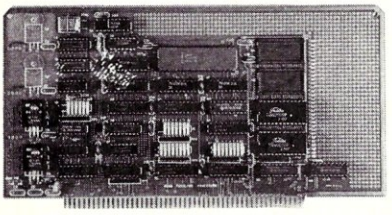
New Products

S-100 8080 CPU card

The Applied Innovations 8088 Auxiliary Processor provides an Intel 8088 processor, sockets for up to 4K of 2716 EPROM, scratchpad, and 4K of buffer RAM space.

The user may add whatever interface circuitry is needed in a prototype area. Processor signals (address, data, and control) are brought out to labeled pads for easy connection.

The Auxiliary Processor is useful for any application where it is beneficial to unload the host processor by using an intelligent controller. An easy-to-use data transfer mechanism is provided and allows independent data transfer between the host processor and the local



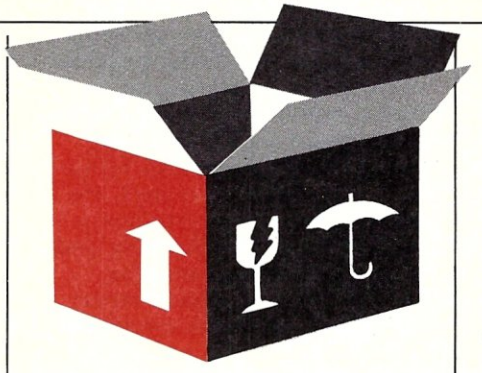
8088. The host processor may be of any type as long as S-100 signal and timing requirements are met; it may be either 8-bit or 16-bit, but the data transfer ports can only transfer 8 bits at a time.

Included is a comprehensive user's manual describing the configuration, operation, interfacing, and programming of the Auxiliary Processor. The user must supply the actual interfacing circuitry, and the exact software required.

Price: $300 A&T, $250 kit, $35 bare board. **Applied Innovations,** *3000 Scott Blvd., Suite 106, Santa Clara, CA 95050.*
CIRCLE 230 ON READER SERVICE CARD

Stand-by power system for micros

A new Standby Power System (SPS) offered by SAFT automatically supplies 200 VA of emergency AC electrical power at nominal 117 volts for a minimum of 20 minutes, taking over the job of power supply



within one-half cycle of line failure. In addition, the device traps and eliminates dangerous spikes and transients in voltage during normal use.

The SAFT SPS is plugged into a power outlet and the computer devices, including mainframe, terminal, and other peripherals, are plugged into the SPS's four 3-prong outlets. As long as line voltage into the SPS is ok, it passes through to the computer. However, if line voltage drops below 102 volts, a sensing device switches to output from the SPS internal battery in 4-6 ms.

The SPS is equipped with three types of alarms: A red indicator light shows that inverter power is being supplied; an audible bleeper provides warning in case the SPS unit is out of sight, and the unit is equipped with an outlet for a signal that can be used to trigger software to begin an automatic and orderly shutdown.

The SPS output waveform is rectangular. 200VA and 400 VA models are available with voltage ranging from 100 to 250 V, 50 or 50 Hz. The device is protected with line and battery fuses and a low battery cutout; battery is a gelled electrolyte sealed lead unit. It is enclosed in a heavy-duty aluminum cabinet and is the same size and weight as an automobile battery.

Price: 200 VA, under $600; 400 VA, under $800. **SAFT America, Inc.,** *931 Vandalia St., St. Paul, MN 55164; (612) 645-8531.*
CIRCLE 231 ON READER SERVICE CARD

Fabric ribbon renewer

Dark-as-original print impressions may be obtained by using the Ribbonizer® on used fabric ribbons. Ribbons may be renewed repeatedly until the fabric wears out or the cartridge fails. Models are designed for popular letter-quality and matrix printers such as NEC, Epson, Radio Shack, and Diablo. The black ink supplied is blended to the specifications of major ribbon suppliers and is available separately when an additional supply is needed.

Long-life, economy-priced renewal fabric ribbons can be ordered from Ribbonizer.

Price: less than $40. **Ribbonizer,** *Box 1727, Redlands, CA 92373; (714) 792-0831.*
CIRCLE 232 ON READER SERVICE CARD

Spooler networks computers and printers

The Digital MultiSpool is a 64K buffer that lets up to five computers share one printer, or one computer share multiple printers. Featuring an automatic memory technique allocating spool storage between devices, the multiport spooler sequentially scans each port, resulting in instant, simultaneous task-transmit-print functions.

Compatible with all popular printers and computers, the Digital MultiSpool uses a single-board Z80 processor, 64K

DRAM, 8K ROM, 4 UART channels, and 2 parallel 8-bit ports; it is packaged in a 12½" x 4½" x 11½" enclosure. LEDs provide a visual status check, and models range from 2 ports, 2 serial to 6 ports, 4 serial, one parallel output and one parallel input.

Price: $595 to $995, depending on configuration. **Digital Laboratories, Inc.,** *600 Pleasant St., Watertown, MA 02172; (617) 924-1680.*

CIRCLE 233 ON READER SERVICE CARD

Plexiglass printer stand

The B.T. Space Saver Printer Stand allows continuous-form paper to be stored under the printer, allowing for easy stacking of completed forms behind the printer. Clear plexiglass construction gives the B.T. stand a clean look for any home or office environment.

Available in many configurations, including regular for 80-column printers and large for 132-column printers. Both sizes are available with an optional shelf for storage of a second type of continuous data form.

The large stand may be purchased with a slot, allowing paper to feed up through the stand in order to accomodate bottom-feed printers.

Prices start at $29.95. **B.T. Enterprises,** *10B Carlough Rd., Bohemia, NY 11716; (516) 567-8155.*

CIRCLE 234 ON READER SERVICE CARD

4-slot Z80 system

MASTERMAX, a 4-slot S-100 Z80 system with dual 8" floppies, features a single-card computer and CP/M. The single-card computer includes a Z80 CPU at 4MHz, IEEE-696.1D compliance, 64K RAM with bank select, and a 4-channel DMA controller. The floppy disk controller handles both single- and double-density data transfers and up to 4 drives (5¼" or 8") in DMA, interrupt, or programmed I/O

mode. In addition, two RS-232 channels are supplied with one channel programmable in either DMA, interrupt or programmed I/O mode and 2 parallel I/O ports; memory management up to 16MB, 8 vectored priority interrupts chained together with I/O interrupts for use with Z80 mode 2 interrupts, and disk emulation (virtual disk).

Two slim-line 8" floppy disk drives are housed in the same

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P.S. We also offer programmer tools in forms of developed and debugged Basic functions and subroutines.

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1 C cross compiler for the 8086. All facilities of the complete C language, including floating point for the 8087, are supported. Optionally, memory can be allocated for use with the 8088. Output is symbolic assembly language. The compiler is suitable for use in porting UNIX to the 8086.

2 Cross assembler/linker/librarian/downline loader for the 8086. Assembler input is an extension to that used by Intel. Loader output is a file in standard Intel hex format.

3 Simulator/debugger for the 8086. Capabilities include display, breakpoints, interpretive execution, as well as many others.

Host System: PDP-11 running RT-11, RSX-11M, UNIX/V6, UNIX/V7; or VAX-11 running VMS, UNIX/32V.

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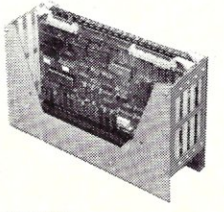

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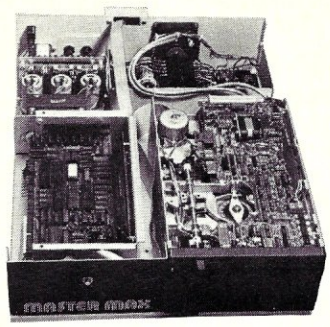

cabinet. The standard unit is supplied with single-sided, double-density drives, but can be optionally provided with double-sided, double-density drives. The system is available for either 110V/60Hz or 220V/50Hz and can be delivered with a wide range of CRTs, printers, modems, and other peripheral devices and software from the Owens catalog. Dimensions: 17⅝″ x 5½″ x 23″; the weight is 45 lbs.

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Price: $2,540. **John D. Owens Assoc.,** *12 Schubert St., Staten Island, NY 10304; (212) 448-6283.*
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256K S-100 dynamic RAM board

Computime has introduced an IEEE-696/S-100 RAM board called the CT256-I. The board supports 64K to 256K using 64K x 1 DRAM memory chips and 256K to 1MB using 256K x 1 DRAM chips. It includes 24-bit addressing, phantom mode and parity error trap options, memory management capability to allow addressing of 1MB RAM for systems generating 16-bit addresses, memory mapping on 16K or 64K boundaries, and refresh cycles performed transparently to the system.

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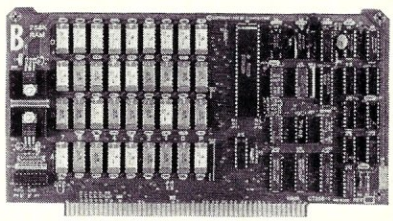

The board operates at 4MHz with no wait states and has options for 200 ns or 150 ns RAMs. An onboard M1 wait-state generator allows use in systems with clocks up to 6 MHz.

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market with dual processor based desktop microcomputers featuring simultaneous 8/16-bit software operation.

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The System 816/A ($5,495) includes CompuPro's 8085/8088 CPU board running at 6 and 8 MHz, 128 KB RAM, 4 serial ports, 1 parallel and 1 Centronics/Epson port, and 2 8" floppy disk drives storing 2.4 MB. CP/M 80, CP/M-86, Supercalc-86, and dBase are standard software offerings.

The System 816/B ($6,995) is the same as 816/A, but contains 256KB of RAM and 6 serial ports to support additional user workstations and a wider complement of peripherals. Up to 40 MB of hard disk storage can be added.

The top-of-the-line System 816/C ($8,995) supports 16 user workstations and a complete range of mass storage peripherals. CompuPro's proprietary MP/M 8-16 is offered standard with this model, which also incorporates 384 KB of RAM, 9 serial ports, and 24 MB of floppy disk storage. As with the other two versions, this multiuser configuration is expandable to 1 MB of RAM, 4.8 MB of floppy disk storage, and up to 40 MB of hard disk storage.

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CompuPro, Oakland Airport, CA 94616, (415) 562-0638.
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Conference on Unix

The second annual Uni-Ops Conference for Unix and C language users will be held March 28-29, 1983, at the financial district Holiday Inn in San Francisco. It is organized into general meetings that focus on Unix's potential, luncheons where users can talk informally, and a vendor exhibition featuring Unix systems and software packages.

Uni-Ops is a nonprofit group interested in the advancement of Unix and C. Its activities include a monthly newsletter, local meetings of users, and tutorials on Unix and C. The registration fee is $65 in advance or $100 at the door. **Contact:** Uni-Ops, Box 5182, Walnut Creek, CA 94596; (415) 945-0448.

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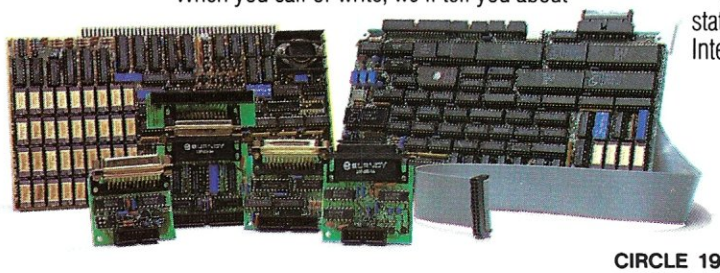

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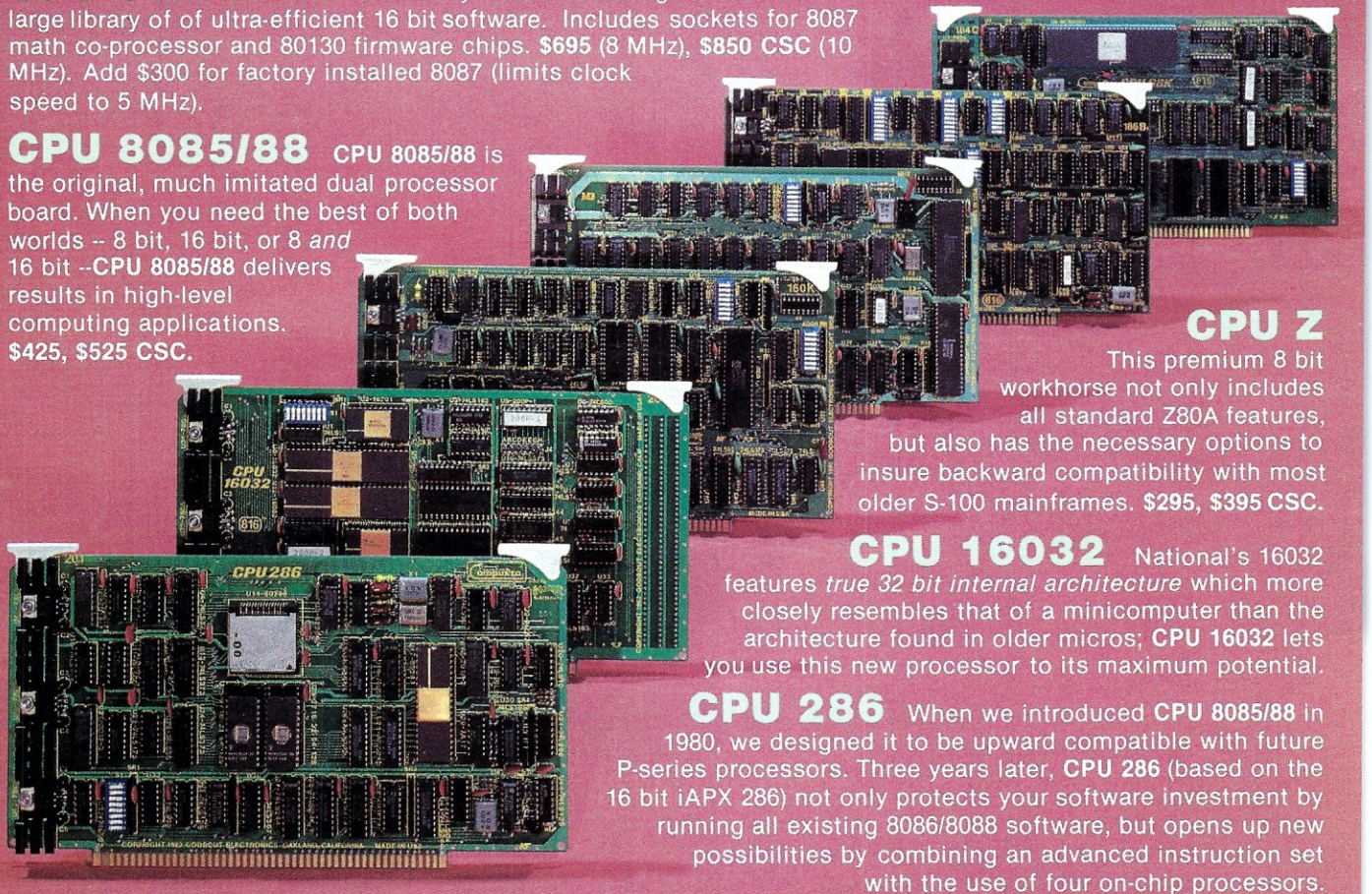

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